The FOUNDRY

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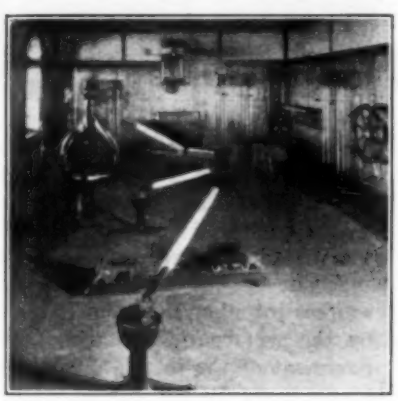
Castings Aid Gymnast in Doing Daily Dozen

KEEPING physically fit through systematic exercises, first recommended by the learned men of ancient Greece, has found favor in practically all civilized countries. Dr. Sargent first introduced gymnastics in this country when he became director of the Hemenway gymnasium at Harvard university in 1879, and to him credit is due for the invention of much of the equipment commonly used. Today the greatest gymnastic training is given in connection with high schools and colleges, where extensive equipment is used, and also in clubs, the Y. M. C. A., etc. Much of the apparatus used in gymnastic training is made in part or in entirety in the foundry, such equipment including chest weight machines, supports for horizontal bars, vaulting horses, etc.



Portion of Gymnasium on a Large Trans-Atlantic Liner

Find Where Castings Can Be Sold.

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Handling Heavy Castings

PULP and paper manufacturing is a typical and pre-eminent Canadian industry with a future of almost unlimited prosperity. This may be traced to two natural advantages of almost equal importance, an abundant supply of growing pulp wood and low priced and easily accessible motive power in large quantities. Data collected at many points and under varying conditions indicate that approximately 100 horsepower exerted for one day is required to produce one ton of paper. From this it is apparent that low priced power is of paramount importance.

Motive power in this industry is restricted almost entirely to hydroelectric energy. Canada's premier advantage and position in the pulp and paper field rests on adequate and abundant waterpower well distributed among extensive forest reserves.

A survey of the waterpower resources of the Dominion carried on by the waterpower branch of the department of the interior indicates that

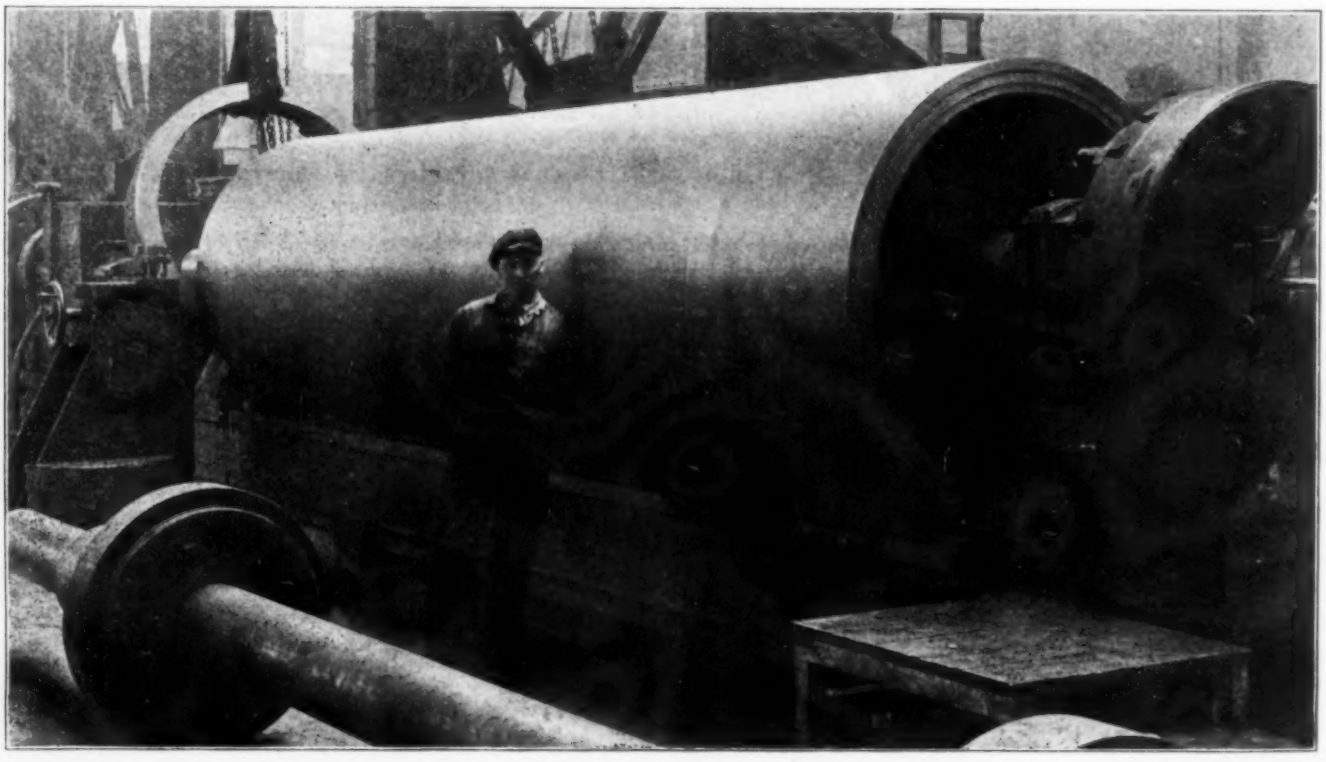

FIG. 1—DRYER SHELLS FOR PAPER MAKING MACHINERY ARE MADE IN VARIOUS SIZES UP TO 20 FEET IN LENGTH AND 5 FEET IN DIAMETER. THEY ARE MOLDED AND CAST ON END

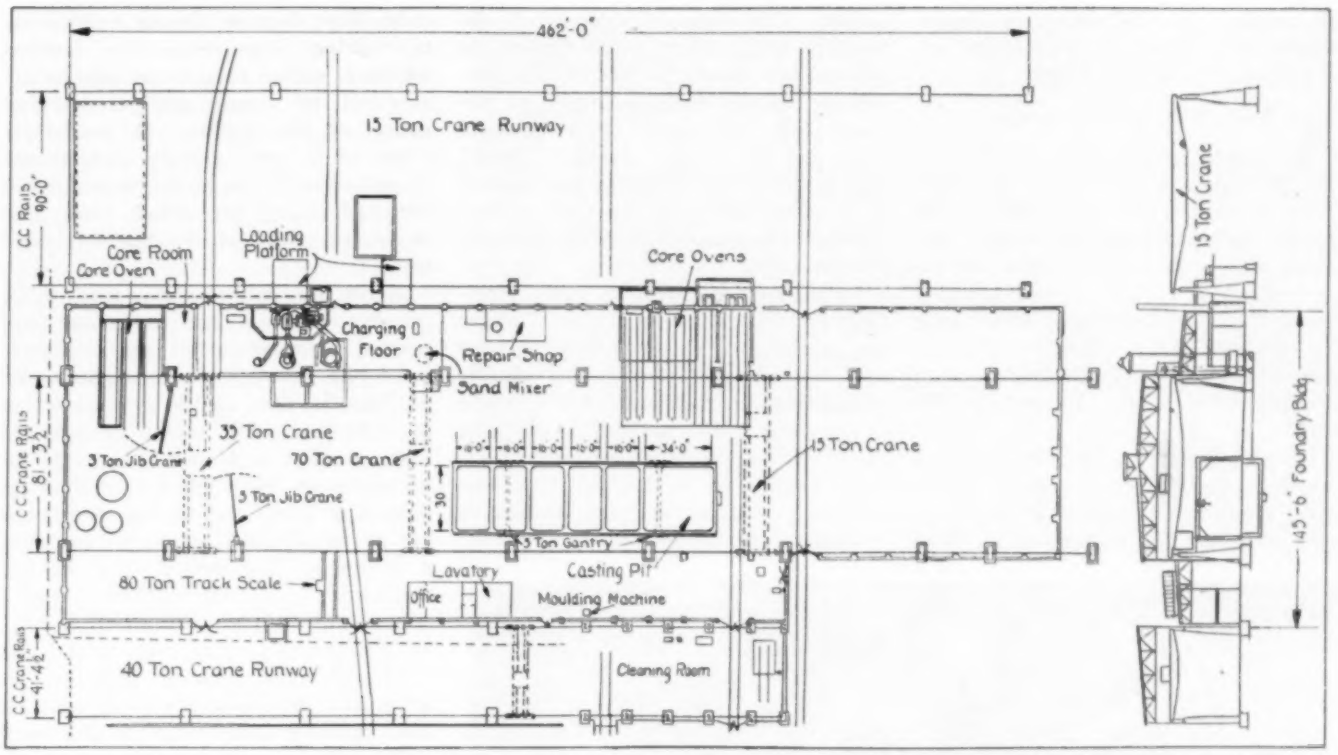

FIG. 2—GENERAL LAYOUT AND SECTIONAL ELEVATION OF THE FOUNDRY SHOWING THE LOCATION AND CAPACITY OF THE PITS, CRANES, CUPOLAS, OVENS TOGETHER WITH THE PRINCIPAL OVERALL DIMENSIONS

the supply is ample for a turbine installation of 41,700,000 horsepower. Total installation to date in water wheels and turbines throughout Canada is 3,227,414 horsepower, or approximately 8 per cent of what it might be and of what it will be eventually in all probability.

Growing demand for power is demonstrated by the numerous large developments that have been pushed to completion in recent years and others that are in contemplation. New developments are not confined to any particular section of the country, but extend from coast to coast and are designed to serve practically every community where a demand for power exists.

Anticipate Demand

With a view to meeting the existing demand and anticipating the demand of the future, the Dominion Engineering Works, Ltd., Montreal, was incorporated in 1920. The new company acquired the paper machine business of the Dominion Engineering & Machinery Co., Ltd., a subsidiary of the Dominion Bridge Co., Ltd., and has engaged in the manufacture of paper making, hydraulic and hydroelectric machinery, as well as in the general heavy foundry and machine work business. Under an agreement with the William Cramp & Sons Ship & Engine Building Co., Philadephia, the company has the exclusive right in Canada and the Brit-

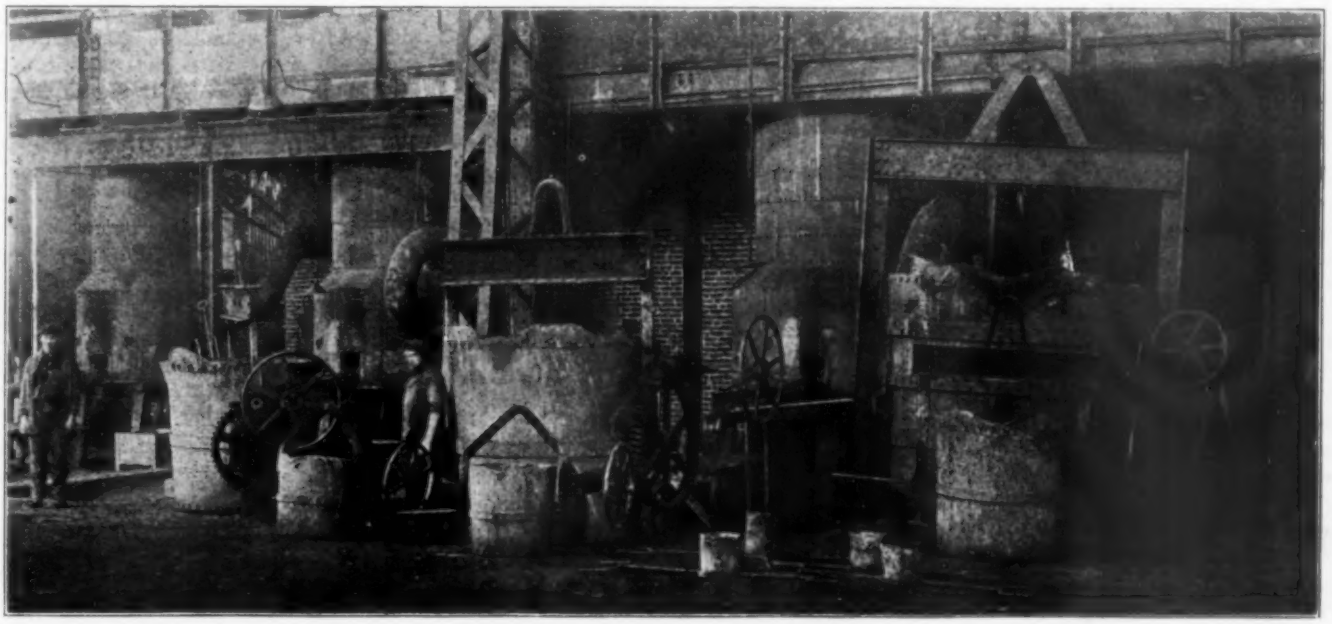

FIG. 3—THE THREE CUPOLAS ARE LOCATED CLOSE TOGETHER TO BE SERVED FROM A COMMON CHARGING PLATFORM. SUITABLE CONCRETE PITS ARE PROVIDED IN FRONT OF THE CUPOLAS FOR THE RECEPTION OF THE LADLES WHICH RANGE IN CAPACITY FROM 1 TO 50 TONS

ish empire to manufacture water wheels and hydraulic machinery according to the Cramp design.

Built For Quebec Bridge

The plant was acquired in 1919 from the St. Lawrence Bridge Co., Ltd., and was constructed originally for the fabrication of the Quebec bridge. This bridge which attracted considerable attention while in process of erection spans the St. Lawrence river near the city of Quebec. It is of the cantilever type and its single central span of 1800 feet is the longest in the world.

The shops were erected on a piece of property containing 25 acres. They were constructed under pressure to meet the steadily accumulating flood of orders that afterward kept the plant working at peak capacity for three years. During the second part of 1924 the business felt the wave of depression that swept over Canada and output was curtailed to a considerable extent.

When first built the machine shop of steel and concrete construction was 660 feet long, 160 feet wide, with an extension along one side 60 feet wide containing the forge, toolroom, power plant and other minor departments. The foundry was 145 x 346 feet. The two-story pattern shop was 60 x 170 feet. With the office and other buildings the total area under roof amounted to nearly 5 acres. Extensions made recently to several of the buildings including 120 feet added to one end of the foundry has increased the area to a considerable extent. The general layout of the foundry with the principal dimensions indicated is shown in Fig. 2. The extension on the extreme right of the main building serves as a cleaning room for the heavy castings. Small and medium size castings are cleaned in a room equipped for the purpose between the foundry building and the machine shop.

Owing to the character of the castings which are made in the foundry the equipment and handling devices are much larger than those usually encountered in casting plants. Tracks in the yard and extending through the shops are laid to standard gage. Cars are shunted in from the Canadian National railroad and are loaded or unloaded with a minimum of effort.

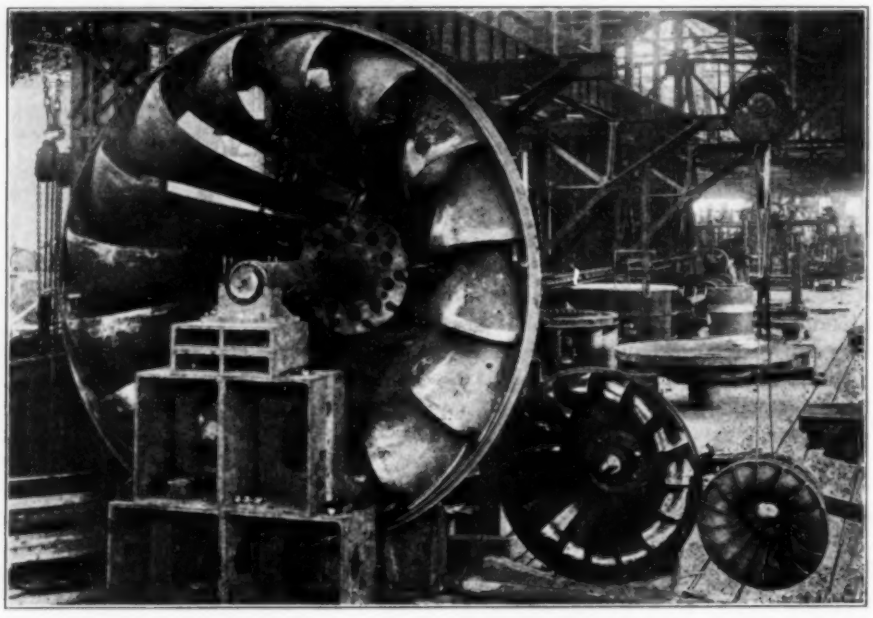

FIG. 4—RUNNERS ARE MADE IN ALL SIZES. THE THREE IN THE ILLUSTRATION READING FROM LEFT TO RIGHT WEIGH RESPECTIVELY 190,000, 9300, AND 2200 POUNDS. THE LARGE WHEEL WAS MOLDED IN FOUR SECTIONS AND AFTERWARD BOLTED TOGETHER

The main bay of the foundry, 81 feet in width, is spanned by three traveling cranes with a combined lifting capacity of 120 tons. The two most powerful cranes, one of 35 tons and the other of 70 tons capacity, were built by the Dominion Bridge Co., Montreal. The 15-ton crane was made by the Northern Crane & Engineering Co., Detroit. The small cleaning room and the continuation of the same space between the foundry and machine shop are served by a 40-ton crane with a span of 41 feet 4½ inches. The stock yard on the opposite side of the foundry and shown in the upper part of the illustration Fig. 2 is served by a 15-ton crane traveling on a runway 462 feet in length and measuring 90 feet center to center of the crane rails.

A space near the north end of the main bay devoted almost exclusively to making large cores for turbine wheels is served by a 3-ton, electrically operated jib crane with a working radius of 180 degrees. A second jib crane of 5 tons capacity and located almost directly opposite, is employed for assembling the dried cores into units for many of the medium sized wheels.

Molds for large wheels and other massive castings are assembled and poured in a group of six, concrete-lined pits shown near the right center of Fig. 2. One of the pits measures 30 x 34 feet. The remaining five are alike in that each one has inside dimensions of 16 x 30 feet. A drain extending from end to end under the center of all the pits terminates in a pump on the outside end of the large pit. Water drained from the pits is removed with a small pump.

Two gantry cranes, one 5 and the other 15 tons capacity, mounted on rails laid on the top of the wall on two opposite sides of the pits supplement the main traveling cranes in handling the work in the pits. From several of the accompanying illustrations it may be noted that large cores enter extensively into the construction of many of the molds made in this foundry. A crane is kept almost constantly in attendance on one of these large molds from the time the foundation plate is put down until the binder beams are placed across the top. The traveling gantry cranes take care of all the detail lifting both in assembling the mold and afterward in stripping the casting. The overhead cranes bring any required material to the pits. This includes the molten iron for pouring the casting. After the mold is stripped, the overhead crane lifts the casting out of the pit and conveys it to the cleaning department near the end of the building.

Mold Drying Equipment

Clearance of 28 feet 6 inches is provided between the floor of the foundry as represented by the base of the column supports, and the lower side of the bridge on the 70-ton crane. A somewhat greater clearance is provided under the two remaining cranes on which, of course, the bridges are lighter. The top line of the columns supporting the crane runway is 31 feet above the floor level and the lowest roof beam is 41 feet 6 inches above the same point.

In passing it might be mentioned that the building is of concrete and steel construction with a wood roof over the greater part of the building. The extension is roofed with concrete.

A cross section of the building is shown at the extreme right in Fig. 2, illustrating among other features the general appearance of the roof over the various parts comprising the foundry.

By referring to the plan shown in the same illustration it may be noted that the mold drying ovens, four in number are located in one of the side bays and almost directly opposite the assembling and casting pits in the main bay. The rail tracks from the ovens extend into the main bay so that the cars may be loaded and unloaded by the cranes. A snatch block anchored in the floor between each pair of rails facilitates the use of the crane in pulling the cars into and out of the various ovens.

Coke Fired Ovens

Mold drying ovens vary in width, but all are of a uniform height of 16 feet and a uniform length of 26 feet. The narrowest oven with a single track is 9 feet. The widest oven is 21 feet 7½ inches and is provided with three tracks. One of the remaining ovens is 13 feet wide and the other is 15 feet 5 inches and each one contains two tracks for the cars.

Two ovens are fired from the outside at one end. The fire places for the other two ovens are located inside one of the end walls. Flues from all ovens lead to a concrete stack erected close to the outside firing chambers.

The coreroom, located at the opposite end of the same bay as the mold ovens is equipped with two ovens 8 feet wide, 24 feet long and 16 feet high. A third oven in the same battery was built especially for drying molds and cores for dryer shells. It is 8 feet wide, 24 feet long and 20 feet high. To utilize the full height of the oven, the track is depressed a sufficient distance to bring the upper face of the car flush with the floor of the oven and incidentally with the shop floor outside the oven. Three deep pits are located at the same end of the foundry for convenience in casting these long upright molds.

FIG. 6—OUTSIDE OF MOLD FOR ¼-SECTION OF RUNNER SIMILAR TO THAT SHOWN IN FIG. 5. THE ENTIRE MOLD IS ABOUT 14 FEET HIGH AND IS ASSEMBLED IN A PIT 8 FEET DEEP

Molds and cores for some of the large dryer shells tax the capacity of the oven. In a second article to be published in an early issue of THE FOUNDRY, dealing in considerable detail with the molding methods practiced, the mold and core will be shown for a casting that measured almost 20 feet in height and 5 feet in outside diameter.

Stock cores and most of the small and medium size cores are made in the coreroom equipped with benches and other facilities in the usual manner. Large cores involving the use of the crane in lifting them onto and off the car are made on the floor of the main bay in the vicinity of the core ovens. Sand for the cores and for other purposes is mixed in a revolving paddle mixer supplied by the Blystone Manufacturing Co., Cambridge Springs, Pa. Loam mixtures and facing sand are prepared in a revolving mixer of the pan type made by the National Engineering Co., Chicago.

Adequate Charging Platform

Three cupolas made by the Whiting Corp., Harvey, Ill., are available for melting the iron. One is lined to 84 inches inside diameter, a second is lined to 57 inches and the third has an inside diameter of 37 inches. When operated together, the three cupolas have a melting capacity of 40 tons per hour. Each cupola is connected to an individual blower supplied by the P. H. & F. M. Roots Co., Connersville, Ind. The blowers are cross connected in such a manner that, any one or any combination of the three may be employed at any time. The layout of the cupolas, blowers and blast pipe is shown in Fig. 2.

Massive construction and ability to withstand hard usage apparent in all the equipment is particularly noticeable in the charging platform. The floor of this platform is made entirely from 12-inch I-beams laid closely side by side. The platform extends over the yard at two points at the back of the building and furnishes a landing place for the materials which are lifted by the crane. Suitable buggies convey the material to any of the three cupolas.

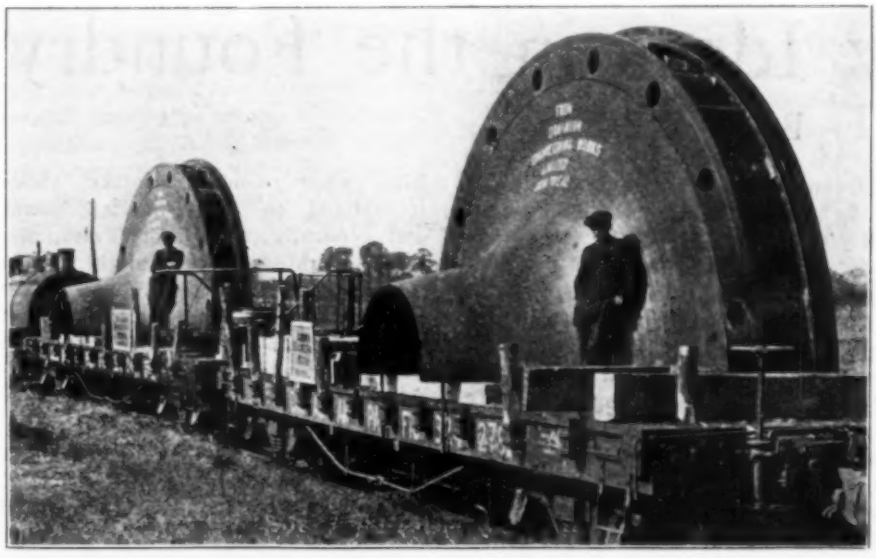

FIG. 5—HALF HEAD COVER CASTINGS FOR 28,000-HORSEPOWER TURBINE. EACH CASTING WEIGHS 60,000 POUNDS

Education Safety Keynote

Metal Section of National Safety Council Discusses Accident Prevention in Metalworking Industries

MEASURES for the prevention of accidents in industry and for general public safety were discussed at the fourteenth annual congress of the National Safety Council which was held at Cleveland, Sept. 28 to Oct. 2. This meeting, which was one of the largest in the history of the organization, brought together over 5000 leaders in the safety movement throughout the country. An exhibition of safety appliances, devices, equipment and services was held in connection with the congress.

One of the largest sectional meetings was devoted to the discussion of safety problems in the metal working industries. Three meetings of this group were held, the first on Tuesday morning being devoted to a symposium of fundamentals of industrial safety education. T. H. McKenney, superintendent labor and safety, Illinois Steel Co., South Chicago, Ill., was chairman of the meetings of this section.

M. E. Danford, works manager, American Rolling Mill Co., Middletown, O., in a paper on "Fundamentals Upon Which the Company Must Work," discussed the necessity of willingness on the part of the company to do its part in making the plant safe through financial aid and by showing interest and enthusiasm, and the benefits that may be gained by the company through properly co-ordinated saftey work.

Education was the keynote of the paper entitled the "Personal Contact Between the Company and the Man," by Phillip Stremmel, assistant superintendent, National Enameling & Stamping Co., Granite City, Ill. He emphasized the necessity of establishing a close personal contact between the employe and the management through the initial contact by the employment department, the influence of the foreman, safety meetings and through bulletins and house organs.

Methods of selling safety to employes familiar only with foreign languages were pointed out in a paper entitled "The Steel Worker and His Characteristics" by A. T. Morey, general manager, Commonwealth Steel Co., Granite City, Ill. Mr. Morey stated that men fundamentally are much the same, but their background, nationality, and environment often are quite different and should be considered as important factors in guiding men to unity thought and co-operative industrial service.

Safety in the operation of plant transportation units was featured in the session on Wednesday morning in a talk by J. A. Hughes, superintendent transportation and labor, Duquesne works, Carnegie Steel Co., Duquesne, Pa., on "Transporting Steel Products Safely." He discussed safe methods of guarding men in the operation of plant railways, locomotive derricks, tractors and yard trucks, and stated that all moving equipment must be in charge of alert, quick thinking and reliable men to insure safety. He stated that great responsibility rests on the foreman, and that he felt the name foreman or boss should be elminated and the title *Educator* substituted.

E. H. Ballard, general foundry and pattern shop superintendent, General Electric Co., West Lynn, Mass., spoke on the "Safe Handling of Molten Metal in the Foundry." This paper is presented elsewhere in this issue. Wearing goggles and leggings were the high points covered in the discussion following this talk. That one plant discarded the use of goggles by men pouring molten metal because the men stated the lenses would quickly steam was attacked by several representatives of plants where each man is required to wear goggles. Mr. Ballard showed with slides the destruction of goggles by hot metal, which undoubtedly would have resulted in serious accidents if they had not been worn. Close inspection of cables in hoists and cranes, was mentioned by W. J. Hanford of the National Malleable & Steel Casting Co., Cleveland, stating this is accomplished weekly in that plant by holding a small piece of waste on the cable as it is lowered. Any break of small strands quickly will show as the waste is caught by the strands.

Selling Safety Ideas in the Foundry

By E. H. Ballard

SAFETY is not easily sold to the average employe. We believe one of the best salesmen is a good safety inspector who is constantly mingling with the employes, not as a watch dog, but as a protector and advisor. His very presence in danger zones has resulted in marked reductions in lost time accidents from handling molten metal, as well as other hazards, which we will show by comparison later on in this paper.

In one of our smaller plants employing about 600 people, it has been our practice for several years to utilize the services of our safety inspector by having each new employe presented to him and he in turn introduces the new man to the foreman on the job, acquainting him with the hazards, explaining the fundamental rules of safety, and the benefits offered by the company, and the new employe's responsibilities. Before the new employe commences work he signs an agreement to use all safety devices furnished him, wear molders' safety shoes, if obliged to carry molten metal, and generally obey safety rules, also to report injuries, even slight, to the proper party. He also agrees to use his best efforts to guard himself and fellow employes against accident. There is every evidence that this agreement entered into with new employes has been very beneficial.

In the plant referred to, both iron and steel casting are produced. Our hazards are common to other plants producing a similar line of work. I will review briefly some of the more important safety measures used.

From a paper prepared for the Cleveland convention of the National Safety Council, Sept. 28 to Oct. 2. The author is general foundry and pattern shop superintendent, River Works, General Electric Co., West Lynn, Mass.

Steel is produced in open-hearth furnaces, charging being done by machine, using the standard design of steel charging boxes, except that our boxes today are provided with numerous cored holes in the bottom to allow moisture to drain away prior to charging of material into the furnaces. Some years ago before drain holes were provided, on one occasion during winter, ice covered scrap was delivered to the furnace platform in charging boxes. After standing for some time the ice melted and as there were no provisions for escape of water, boxes when charged into furnace contained considerable water. When boxes were dumped, water coming in contact with hot furnace bath caused an explosion resulting in damage to the roof. By providing drain holes this hazard has been eliminated entirely.

We have provided a covered scrap storage, which also removes the hazard of charging wet scrap into the furnace. This covered storage building is more than paying the investment charge, and is considered a good investment and safety measure.

Our furnaces are tapped from the spout side of furnace into crane ladles from a swinging platform, well guarded, allowing men tapping out perfect freedom of action and protection from accident.

All cranes are inspected mechanically and electrically each day and each week every foot of cable is cleaned with kerosene and careful inspection made. Ladle bails are of the detachable type, and they too are inspected systematically, together with the ladle trunnions.

We are obliged to transfer considerable portion of the steel from one building to another, which is done on a specially constructed ladle car of standard gauge, with a storage battery transfer car as a moving agent. In transferring ladles of molten metal about the shop, it is always customary to have someone precede the crane, warning those who may be in the path of travel. Ladles are carried just as close to the floor as possible.

In pouring steel all men working about the pouring floor are provided with and use special glasses. The upper portion of lenses are blue with plain glass in the lower portion. This combination allows clear vision for the men to move about safely, and the upper section provides protection from the intense light of the hot metal, and saves many eye injuries from flying sparks.

We are firm believers that the utmost rigidity is essential in ladle shells, especially in large capacity ladles used for steel, which prevents cracking of lining bricks and distortion which affects the stopper mechanism. There is evidence that this point is sometimes overlooked.

Ladle Slides—Gearing, stopper rods, and accessories; graphite stoppers, sleeves and nozzles, are each in themselves vital factors in the safe handling of molten metal. Great care is given our ladle stoppers and rods before use. Stopper rods are dried out for at least ten days prior to using. It seems to the writer that too much attention to the details is impossible when we consider the important part the stopper mechanism plays in controlling the pouring of large masses of molten steel.

New Officers of Metal Section
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Iron Foundry

About fifteen tons of molten metal are handled daily, all going into light work, which is hand poured.

Each molder is provided with a pair of goggles, which he religiously uses when handling molten metal.

From the stock room each molder secures daily a pair of standard leggings, and returns them when through for the day. By this system all leggings are inspected daily and kept in good condition and only those safe for use are given out. Daily inspection of safety shoes worn by the pouring gang is made also.

During the casting period the safety inspector is found usually in front of the spout, and the dangerous practice, which was followed in days gone by of molders cutting into the stream to fill hand ladles, has gone, and one of the greatest hazards removed. By supplying metal to hand ladles from the reservoir ladle, a safe and sane method has superseded the dangerous one, and lost time accidents reduced to the minimum.

The mere presence of the safety inspector on the job at times deters some of the more anxious ones from breaking this rule.

Cast iron overiron troughs are provided and conveniently located, eliminating the dangerous practice of pouring surplus metal on the floor for some one to walk into.

It is our custom to maintain straight aisles and keep all gangways clean. No curbings or rails are allowed above floor level.

Crane ladles are of the geared tilting type. One of our larger foundries recently has changed most of the old worm gears for the improved spur gear type, which insures the ladle remaining in a given position, and is tilted easily for pouring. A common, dangerous practice of carrying the crane ladle containing molten metal about the shop in other than a vertical position should be guarded against.

General Observations

A suggestion recently advanced which has much merit, is that in designing new foundries and remodeling old ones, that consideration be given to provide safety galleries back of crane cages to permit an easy exit in case of a bad spill or excessive heat from floor. Also that all crane cages should be well protected from a spill of iron or steel. It often happens that stoppers become frozen in the nozzle. A variety of methods are employed to raise the stopper out of nozzle, most of which are attended with more or less danger from molten metal.

Good flask equipment with proper flask joints should be maintained. The majority of our flasks are metal, and very little trouble is experienced from runouts. Most foundries do have some wooden flasks. One of our foundries provides a one inch thick strip on the joint face of both cope and drag, and replace when needed at little expense, insuring greater safety.

Slag spouts on cupolas should be equipped with suitable shields to prevent blowing sparks and slag on to operators or passersby.

Blast pipe from the blowers to cupolas should be equipped with suitable back pressure safety gates so that there is no danger of carrying flame and fire into the blowers causing explosions of gases.

One of the indirect means of safely handling molten metal is stabilization of employes. One of the contributing factors is suitable provision for the

(*Concluded on Page* 823)

German Foundrymen Hold Show

A Small Foundry Was Shown in Operation at the Recent Convention and Exhibition Held in Dusseldorf

By Hubert Hermanns
German Correspondent, THE FOUNDRY

AT THE convention recently held in Dusseldorf the Associated German foundries also staged an exhibition divided into three parts: a scientific department, a practical-technical department and a model foundry operated under modern methods. The scientific department was designed to show the advantage of scientific management in foundries and also the extent to which scientific methods have been adopted in German foundries. In the practical-technical department a number of new machines and contrivances were exhibited which indicate that the foundry industry is engaged earnestly in further improving its methods and practices. The model foundry operated on a small scale showed how a small foundry properly designed and equipped may reduce its production costs by making use of labor saving appliances.

The exhibition was housed in four main halls with the scientific department overflowing into three adjacent wings. The practical-technical department was located in Halls II and III and the model foundry was operated in Hall IV situated approximately 220 yards from the main building.

Principal features of the model foundry are shown in the ground plan Fig. 2. The molds were made on machines and assembled on a conveyor where they were poured at a point close to the cupola. The castings were shaken out at the end of the conveyor and loaded on trucks running on an industrial track to a point where the castings were dumped on the floor to cool before they were tken to the cleaning room. The empty flasks, plates and other accessories were placed on a second conveyor which delivered them again to the molding station. The cupola was charged mechanically by electrically operated buckets.

Cheapening the product is of vital importance to the German foundry industry, highly burdened by taxes and social duties for workmen and employers.

Production costs, as a rule, are considerably higher than abroad. Germany is compelled to sell a large part of her production in foreign countries and this is impossible unless production costs are reduced to a point where they may meet foreign competition.

Realizing that reduction of production costs essentially is based upon the education of workmen, foremen and production engineers a large part of the scientific department dealt with the questions of apprenticeship and of instruction for foremen and superintendents. The highly intricate subject of scientific management was divided in the following principal groups: Preparatory work and organization; layout of foundries; molding detail; metallurgy in the foundry; inspection and refinement of cast iron.

The practical-technical department presented a comprehensive view of what the German machine makers already have accomplished for the foundry plants. A new type of a turnover molding machine with mechanical sand compression built by Kuenkel & Wagner is shown in Fig.

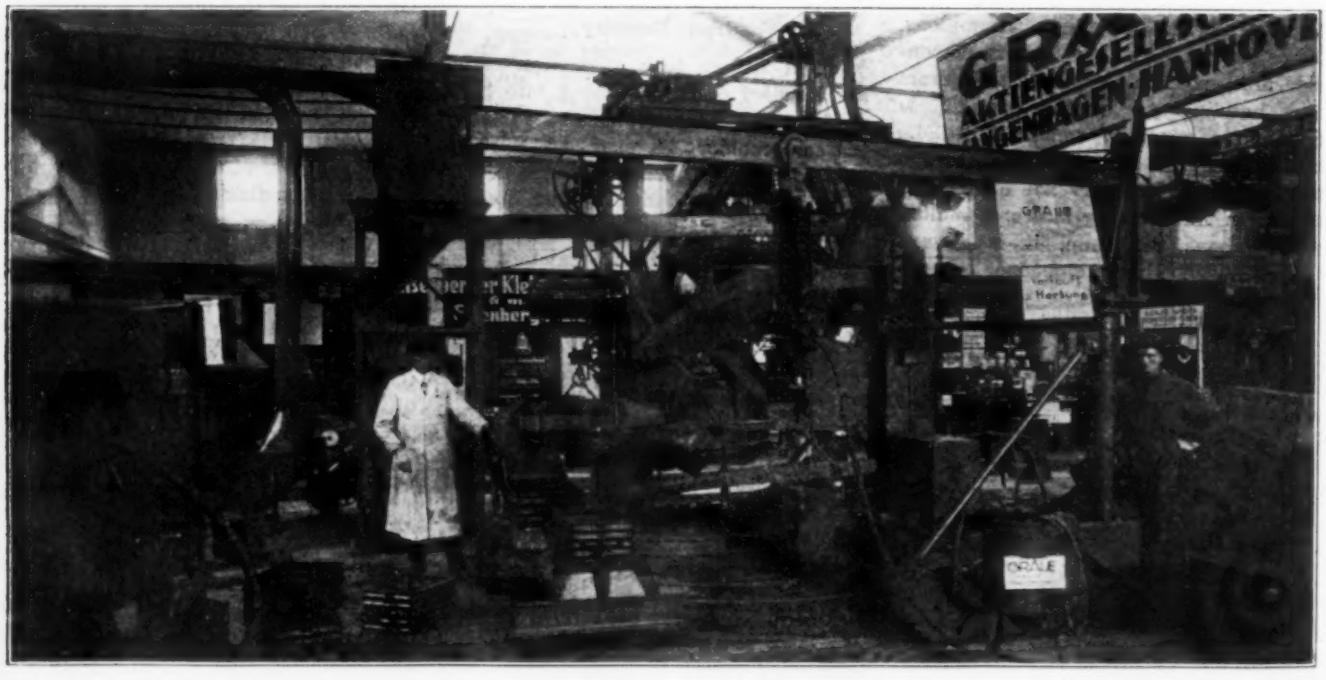


FIG. 1—PART OF THE DISPLAY OF THE GRAUE CORP., LANGENHAGEN NEAR HANOVER FEATURING THE SAND THROWING MACHINE AND OTHER PIECES OF AMERICAN FOUNDRY EQUIPMENT

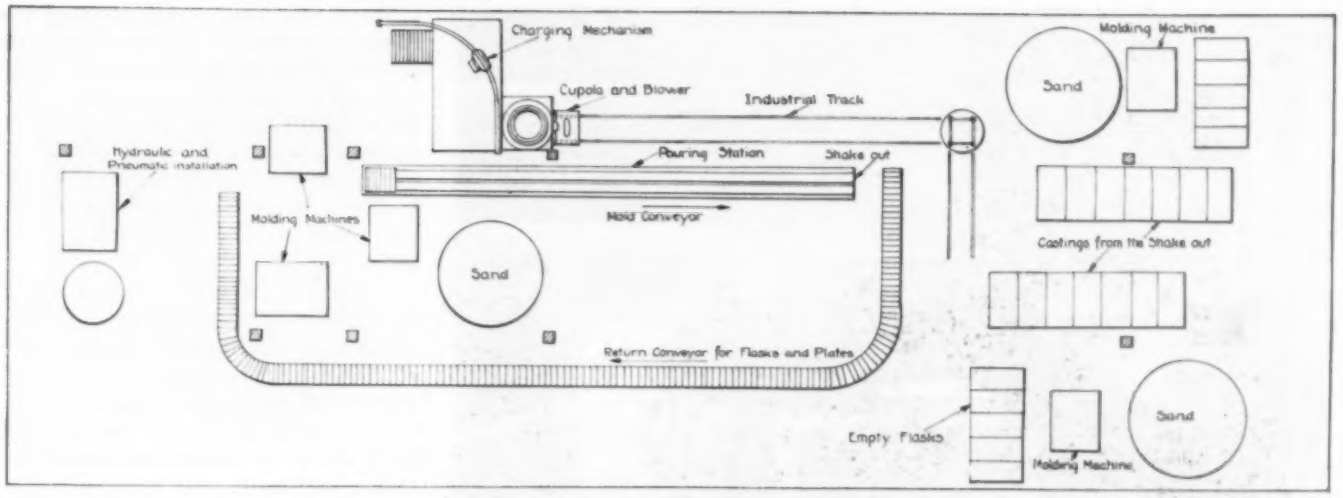


FIG. 2—GENERAL LAYOUT OF THE MODEL FOUNDRY IN WHICH A WORKING DEMONSTRATION WAS GIVEN OF CONTINUOUS MOLDING AND POURING

3. In this machine the squeezing device is so arranged that it may be slewed to one side so that the total surface of the flask is left accessible. The rails are disposed in the rear and provided with rollers for opposing pressure in such a way that the flask carriage cannot tilt as the finished molds are withdrawn.

The head of the piston, guided in the hollow column and in the cylinder cast integral with the hollow column and placed beneath, supports an iron plate planed on both sides and fastened by bolts. As the lateral lever is lowered the cross shaft is turned and with the same a gear which lifts the piston and consequently the flask carriage intended to withdraw the flask. The carriers of the turnover top table are adjustable in a vertical direction. The press plate is kept in its upright position by two coil springs.

A portable hand squeezing machine for snap flasks and shown in Fig. 4 was exhibited by Eberhard & Co. The

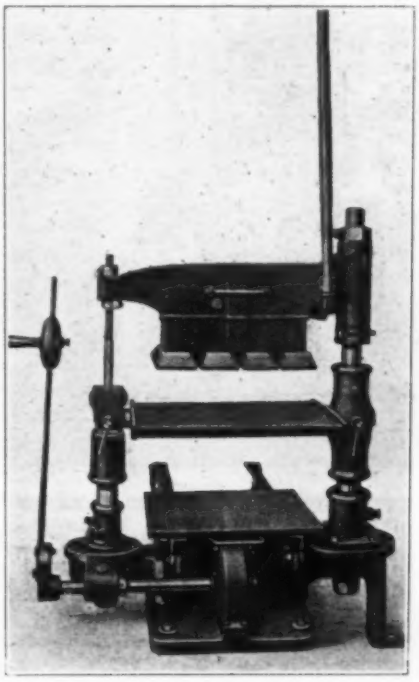
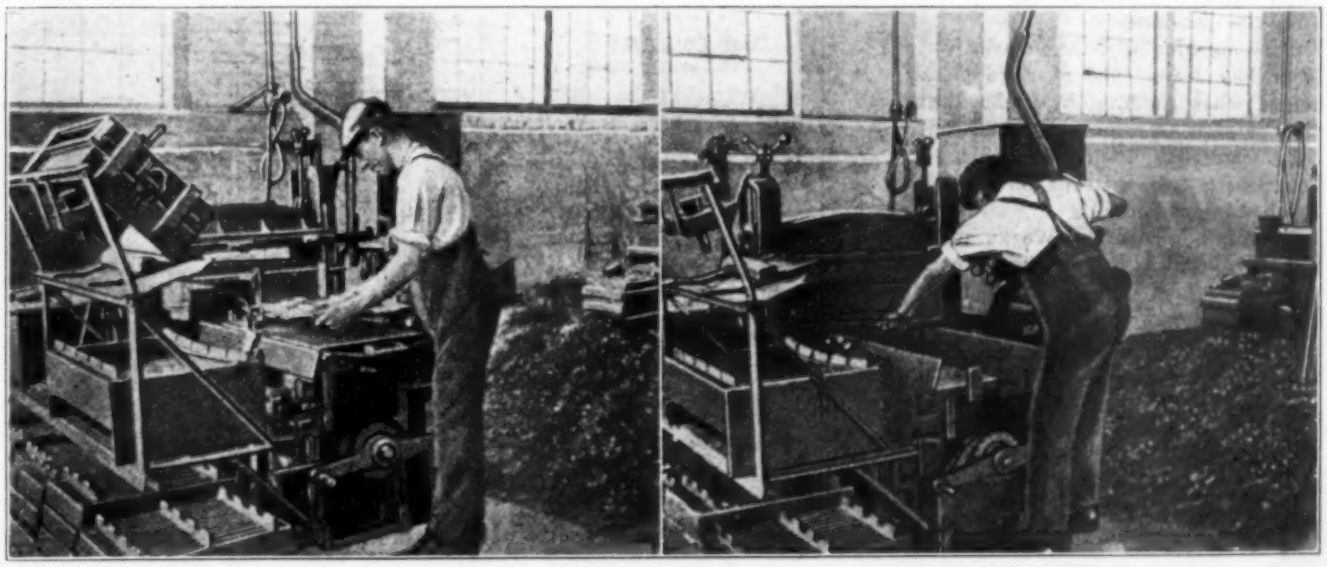


FIG. 3—SQUEEZER MACHINE PROVIDED WITH A MOVABLE TABLE

machine was designed for simple handling and free working up to the top and sides. All unnecessary movements are avoided. Upper and lower halves of the mold are made on the one machine. The drag half of the snap flask is placed on the pattern plate and after the pattern is covered with facing sand taken from a sand box at the right of the machine, filling sand is shoveled in from the heap. Then a grid is pressed into the lower half and the flask is rolled by a turn of the crank. The cope half of the flask is placed and filled with sand. The mold carriage is disengaged with the left hand and pushed under the squeezing plate. The right hand pulls down on a lever and brings the squeezing plate into action as shown in Fig. 5.

After the lever is released the flask is withdrawn. A pneumatically operated stripping device lifts the cope a sufficient distance to clear the patterns from the drag. A further turn of the crank lifts the cope from the pattern plate and places it on edge



FIGS. 4 AND 5—HAND SQUEEZER MACHINE PROVIDED WITH MOVABLE TABLE AND A CRANK AND LEVER ARRANGEMENT FOR LIFTING THE COPE AND PATTERN PLATE

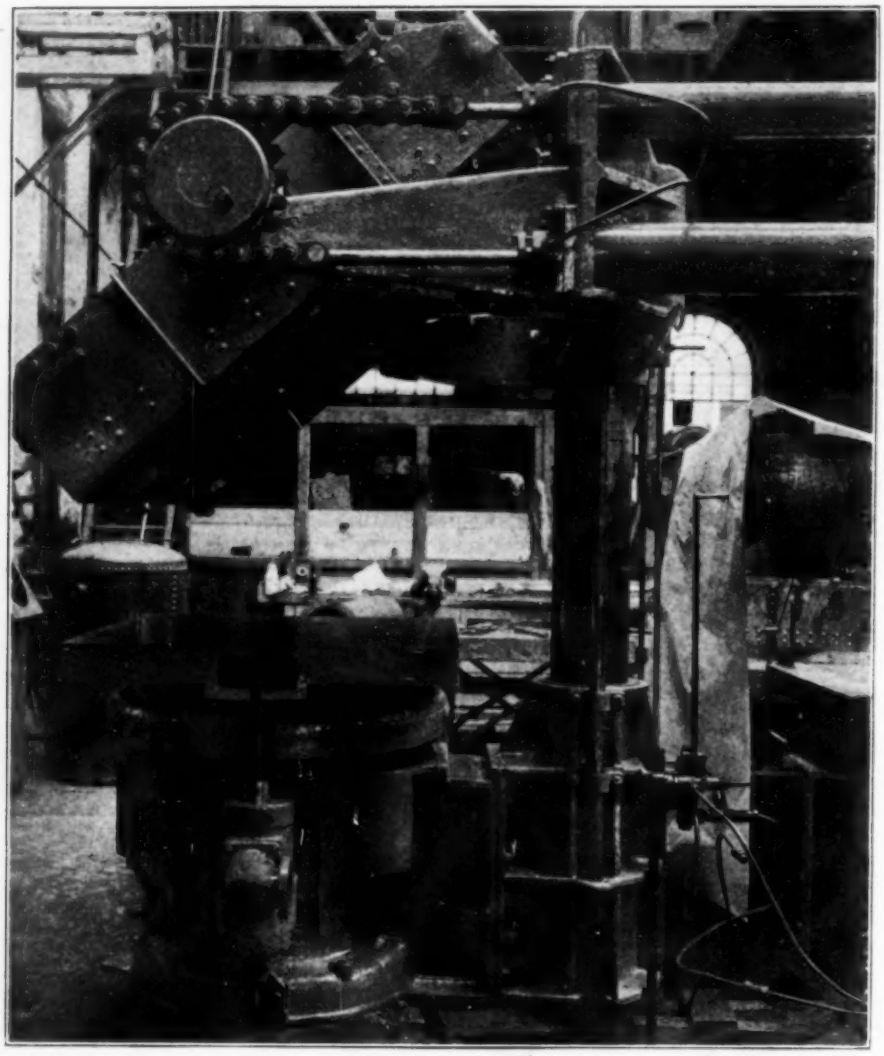


FIG. 6—AFTER THE MOLD IS JOLTED IT IS PICKED UP AND ROLLED OVER BY A DEVICE OPERATED HYDRAULICALLY

on the putting-away device shown at the left in Fig. 4. The pattern plate then is removed, any necessary cores are inserted and then the crank is reversed to place the cope back on the drag. The snap flask is removed and put away to the left and the finished mold is placed on the floor behind the machine.

This machine will take flasks up to 12 inches deep. The average performance when molding brakeshoes with one pattern on the plate and with three cores is 16 to 18 molds per hour; with two patterns on the plate 12 to 14 per hour.

Zimmerman Machine Works specializes in shockless jarring machines in which the load does not fall directly on the base plate but is taken up by a movable anvil supported on springs. Compressed air admitted into the cylinders lifts the table while the anvil remains in its position with compressed springs. With the reversal of the stroke the plate carrying the mold descends freely while the relieved anvil snaps up. Both parts hitting together produce a shock that is absorbed within the machine instead of being transferred to the foundation.

The newest type of jolt molding machine is shown in Fig. 6. After the mold is jolted it is elevated by a pair of arms attached to a hydraulic hoist. While in this position it is rolled over by a chain and sprocket wheel actuated by piston rods mounted in two horizontal hydraulic cylinders. The load then is lowered back on the table.

The most extensive display of the exhibition was presented by the Graue-Aktiengesellschaft with many pieces of American equipment including the sand throwing molding machine made by Beardsley & Piper, Chicago. Exhibits of Graue-Aktiengesellschaft are shown in Fig. 1.

German foundries have displayed considerable interest in the economical preparation of molding sand. Much work still remains, but many features indicating progress were in evidence at the recent exhibition. The Badische Maschinenfabrik showed a complete molding sand preparation plant with two molding machines. The jolt machine with automatic rollover and lifting devices operates on sand made up of 8 to 9 parts of old sand to 1 part new sand. The machine handles flasks up to 32x40 inches, 24 inches deep and turns out one finished mold within 4 or 5 minutes with two men. It is operated with compressed air at 85 to 100 pounds pressure to the square inch. The pattern plate is equipped with two vibrators on the back which facilitate the drawing of the pattern from the sand. It is claimed that even wood patterns with high steep walls may be withdrawn mechanically from the mold with the aid of the vibrators.

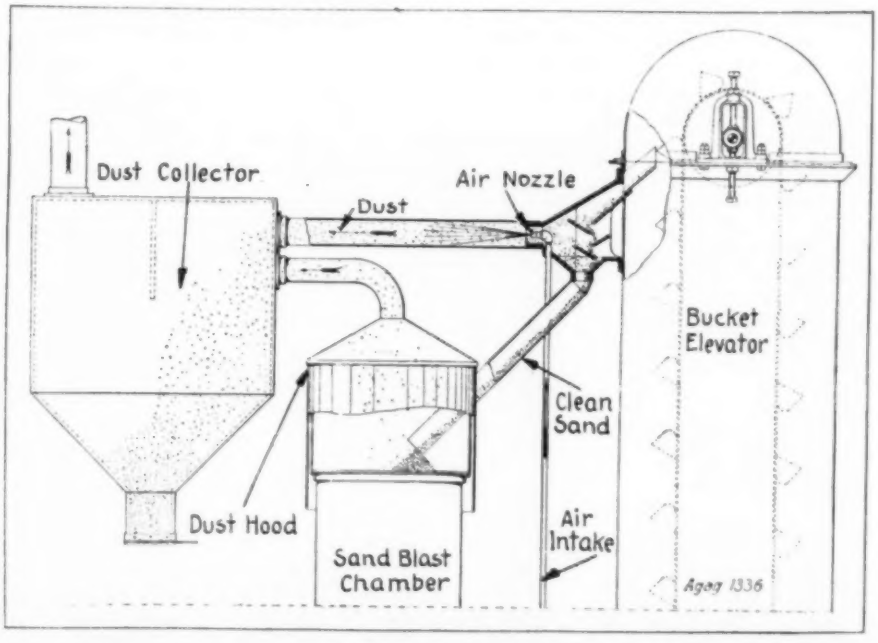


FIG. 7—SPENT SAND FROM THE SANDBLAST DEPARTMENT IS RETURNED THROUGH A NOZZLE WHICH SEPARATES THE SAND FROM THE DUST

FIG. 8—SAND IS PREPARED IN A COMBINATION RIDDLE AND EDGE MILL

Flasks are fastened rigidly to the pattern plate by an automatic device pneumatically operated which snaps into place the instant the flask is placed on the plate. Many holes are provided on the pattern plate for the accommodation of miscellaneous pat-

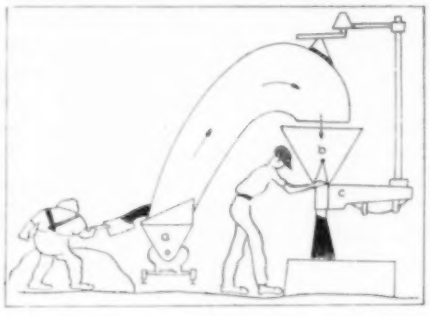


FIG. 9—PROPOSED METHOD OF PREPARING SAND

terns which may be attached or detached rapidly.

The sand conditioning plant supplying the two molding machines is connected directly to the hopper under the shakeout grating by an underground conveyor which delivers the sand to the first bucket elevator where it is brought over a magnetic drum separator to a polygonal sieve. The sand then drops into the charging hopper of a second bucket elevator which delivers it into a movable filling hopper on the molding machine.

Hammers Machine Works, Karlsruhe, showed the sand dressing device illustrated in Fig. 8. The used sand is shoveled into the revolving riddle A while the new sand is delivered directly to the edge mill B where the runner C and another runner in the rear of the mill produce a thorough mixture of the sand. The scoop wheel D with three scoop arms takes up the mixed sand from the grinding path of the mill and drops it into reservoirs placed behind the machine.

Centrifugal force is utilized in the device working on the Axmann system shown in Fig. 9. By means of a sand throwing apparatus *a* the sand shoveled in is raised into a bunker. Beneath this bunker and above the mold there is another sand throwing machine *b* which also mechanically throws the sand into the mold. This machine has not yet been placed in actual production.

The dust separator illustrated in Fig. 7 and shown by Gutmann is intended to clean the blast sand from dust, molding sand and other impurities. Cleaning is accomplished by a separator located at the discharge end of a bucket elevator where the sand rippling down over a series of inclined vanes is aerated by a current of air. The dust is taken away by the air current and deposited in the collection chamber. The cleaned sand drops back into the sandblast reservoir through an inclined pipe.

The device shown in Fig. 10 and intended to take the cores out of castings has been introduced into many German foundries. The casting to be cleaned is placed on the point of the rod R which then is vibrated rapidly by the air hammer H inside the casing G.

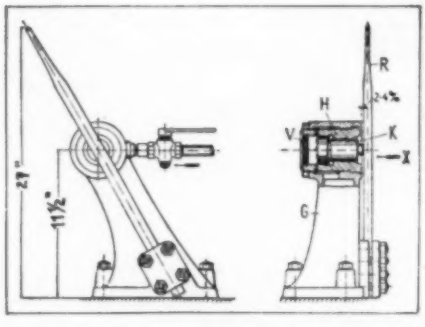


FIG. 10—VIBRATOR FOR CLEANING SMALL CASTINGS
EACH PISTON MAKES TWO POWER STROKES PER REVOLUTION

Selling Safety Ideas in the Foundry

(*Concluded from Page* 819)

health and convenience of employes in wash rooms, toilets and locker rooms, shower baths with heating facilities that they may be used in winter as well as in summer.

Where Americanization work is carried on, the writer suggests that some of the lessons in English be taken from the plant safety slogans and notices as a further means of creating interest and education in safety work.

When we analyze the accidents in plants well guarded mechanically, it is generally conceded that the major portion of accidents are due to personal carelessness, which emphasizes the importance of the personal educational work so necessary if we are to maintain low accident records.

Use American Tractors in Russia

Russian peasants are using 7500 tractors, most of them imported from the United States during the past year, according to a dispatch received by the Russian information bureau at Washington. Moreover, an additional 3800 were enroute to Russia from American ports in September. Cooperative societies report they have orders from the peasants for 20,000 tractors. Before the war there were less than 500 tractors in the entire Russian empire. Of the tractors imported this year 99 per cent have been from the United States.

Book Review

Construction and Operation of the Steel Converter and Small Bessemer, by Hubert Hermanns, 247 pages, 6¼ x 9½ inches; published by Wilhelm Knapp, Saale, and furnished by THE FOUNDRY at $3.50 in paper and $4 in cloth and in Europe by Penton Publishing Co., Ltd., Caxton House, London, for 15 shillings and 20 shillings, net, respectively.

The former work by this author, "The Modern Siemens-Martin Furnace", received so kindly a reception from critics the world over that he was emboldened to write the present volume along the same lines, treating it from the historical point of view as well as from the engineering. Portraits of Bessemer and Thomas, inventors of the converter principle, adorn the volume, as well as 217 illustrations and charts, many tables and a complete bibliography.

An interesting bird's-eye presentation of the various iron and steel processes is presented in a two-page reproduction of a diagram and cross section of various types of plants engaged in production of these materials. Construction and operation of the early types of converters are described and illustrated. An interesting feature throughout the entire work is a series of cross sections and ground plans of representative German plants devoted to production of converter steel, giving the practical solution of the problem in addition to the theory.

Throughout, the volume gives evidence of earnest investigation and desire to present the subject fully and to show all sides of the problems accompanying production of converter steel. The text is in German.

Malleable Furnace Fired With Pulverized Coal

Economy in Operation Secured Through Replacement of Hand Fired Method with New System

By Warner Hathaway

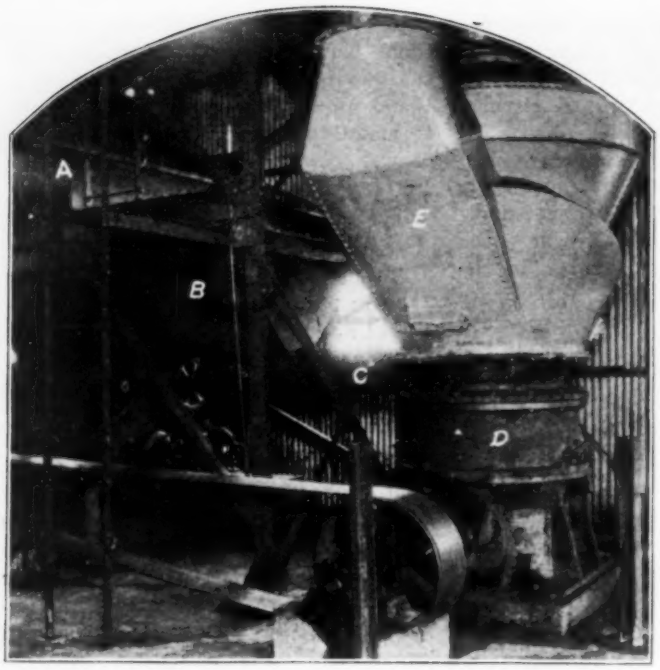


Fig. 1—Coal Is Crushed in a Mill and Then Collected

ONLY in the last ten years has the malleable iron industry shown marked progress in its methods of manufacture and improvement in the quality of its product. Prior to that time little or no scientific or technical research work was carried on by the foundries. The increased demand from the automotive industry for better service, greater production and a product meeting the technical specifications of the engineering profession, has caused the malleable foundries to adopt modern methods of manufacture. Any methods or equipment which will reduce costs, increase output, and better quality thus permitting the foundry to meet competition, now are being adopted rapidly. Pulverized coal is a system which meets these demands.

Two of the greatest sources of trouble and expense in the industry were the old fashioned, crude methods used in melting and annealing. The loss of fuel was enormous. Controlling firing to obtain perfect combustion was extremely difficult. With hand firing it was necessary to employ a low class of labor, as the excessive heat and long hours made it almost impossible to obtain intelligent firemen. These firemen realized the situation and were exceedingly independent, making it necessary to have two crews. Holidays and Sundays were the bane of the foundry superintendent's life for he knew that some one of his firemen would not be on the job at heat time, or would be in no condition to care whether or not the iron was oxidized or the heat on time. Oxidized iron meant loss in production, and often a loss of customers, through failure to meet their specifications or delivery dates. Late heats meant loss of production, for the floors were filled with molds and no more could be produced until those already made were poured. This caused dissatisfaction among the molders and when it occurred too often, meant the loss of the piece-work molders.

The same condition existed in the annealing department, as far as that class of labor was concerned. The length of time to run out an oven

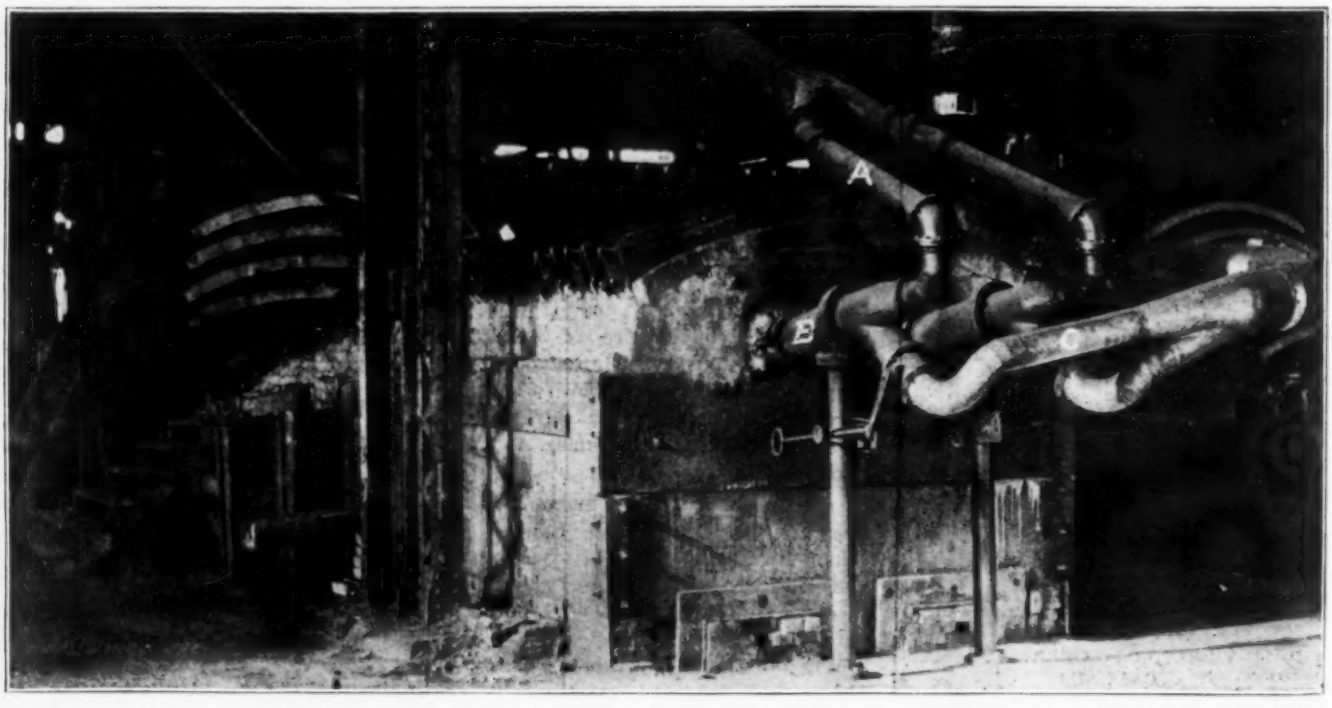


FIG. 2—LITTLE CHANGE WAS MADE IN CONVERTING THE HAND FIRED FURNACE TO ONE USING MALLEABLE IRON

could not be depended on, nor could uniform temperatures be maintained at all points of the annealing furnaces.

With the adoption of pulverized coal for fuel all of these troubles have been overcome. No longer are the firemen a cause of constant worry as intelligent and dependable men may be employed. There are no more late heats; the iron is of the best and of a uniform quality. A regular schedule is maintained both in melting and annealing. The metal, melting and annealing costs are greatly reduced.

It is not the purpose of this article to give all the details of the methods employed in using pulverized coal as a fuel in the malleable industry, but only to cover them in a general way, for the benefit of those not familiar with its use. The comparative data on pulverized coal and hand fired methods given in the accompanying table shows the saving realized.

WARNER HATHAWAY, the author of this article, formerly was connected with the Western Malleable Co., Beaver Dam, Wis., a four furnace shop manufacturing automobile and railway castings, when he supervised the installation of the powdered coal system of firing malleable furnaces by the Holbeck Engineering Co., Cleveland. Mr. Hathaway is a graduate of the University of Wisconsin, and has been connected with the malleable industry in various capacities for 13 years.

The common impression of the man who has never used pulverized coal is that it is extremely dangerous to handle, because of its explosive character. However, with the system described, this danger has been overcome. This is accomplished by having an excess of coal, as compared with air, in all pipe lines and containers. Since the amount of air is too small to maintain combustion, this danger is eliminated.

Another point to bear in mind is, that by pulverized coal, is meant coal so finely ground that it has the appearance of smoke, and may be handled like a gas in pipe lines. Some think that pulverized coal is ground to about the fineness of sand and is difficult to handle, becoming packed in the lines and equipment.

The pulverized coal plant is contained in a fire-proof building, centrally located, to serve the foundry and annealing departments to the best advantage and with the shortest possible pipe lines to the furnaces.

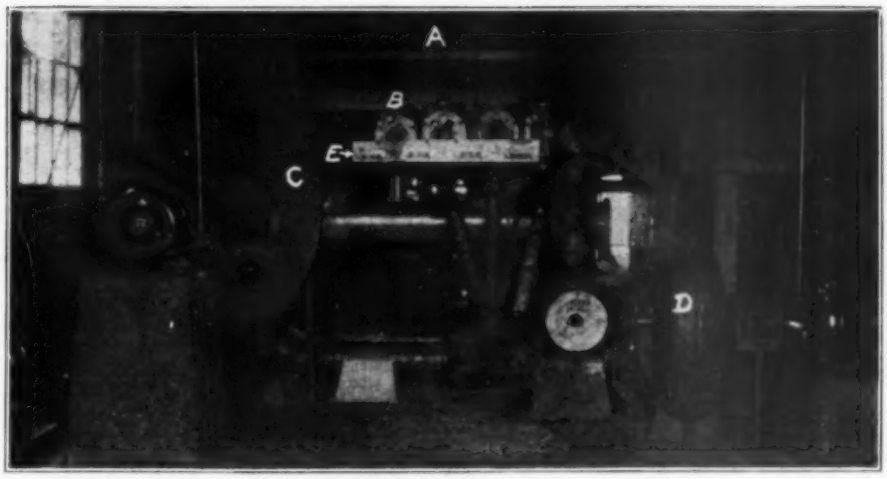


FIG. 3—FANS AND FEED SCREWS ARE USED IN THE TWO MAIN LINES

Coal, either egg, nut, or slack, is received in drop-bottom gondolas, or hopper cars. From these it is fed through a track hopper into a roll crusher. This crusher breaks the coal to uniform size, about that of a walnut, and drops it upon a conveyor belt. A powerful magnet is located directly over this belt, removing bolts, nails and other foreign iron parts from the coal. After passing under the magnet, the coal enters the bucket elevator and is elevated to a dryer.

This dryer is a large steel drum, about 30 feet in length and four feet in diameter. It is set at an angle, the crushed coal entering at the higher end. Heat is passed through the drum, from a fire-box located at lower end of drum. No flame comes in contact with the drying coal, the drying being accomplished by indirect hot air, controlled by baffles. The drum is mounted on rollers and turns slowly, the coal gravitating toward the lower end. The speed of this dryer may be controlled, so that provision may

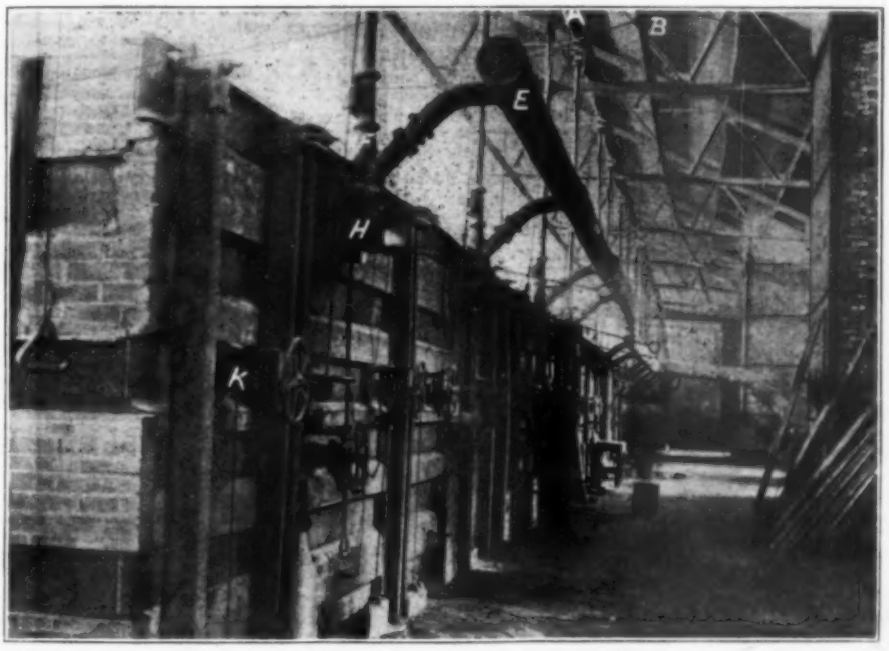


FIG. 4—CONVERTING THE ANNEALING FURNACES NECESSITATED CONSIDERABLE WORK

Table I

1000 Ton Monthly Report Melting Furnaces Hand Fired

Iron melted, tons	1,800
Number of furnaces	2
Number of heats per day, per furnace	2
Number of days per month	22
Total number of heats	88
Average size of heats, tons	20.4
Melting time, first heat, hours	9.6
Melting time, second heat, hours	7.0
Melting ratio	3.42
Coal used, tons, Kentucky lump	526.3

OPERATING LABOR

Two furnacemen at 55 cents—12 hours per day	$13.20	
Four firemen at 55 cents—12 hours per day	$26.40	
Two ashwheelers—12 hours per day 40 cents	$ 9.60	
Two coal wheelers, 12 hours at 40 cents per day	$ 9.60	
Cost per day	$58.80	
Cost per month, 22 X $58.60		$ 1,293.60

MAINTENANCE

Bricklayer at $120, helper at $90 ½ charged to melting	$ 105.00

Brickwork—Side walls same as for P. C. bungs last 16 heats on hand fire. P. C. bungs take 1,088 brick per furnace. Total heats equal 88. 88 ÷ 16 equals 5.5 time bungs are renewed. 5.5 X 88 X $59 equals $353.06.

Total maintenance cost = $353.06 + $105	$ 458.06

COAL COST

Coal cost per ton at mine, Kentucky lump	$ 2.50
Freight	3.15
Tax	.095
Unloading	.200
Total cost per ton to ground	$ 5.945
Total cost = 526.3 X $5.045	$ 3,128.85

SUMMARY

Total coal cost	$ 3,128.85
Total operating labor	1,293.60
Total maintenance	458.06
Total net cost	$ 4,880.51
Cost per ton of iron	2.71
Cost per ton of coal	9.27

FIXED CHARGES

Total investment	$125,000
Interest 6 per cent	7,500
Cost of building	40,000
Depreciation of buildings 2 1/3 per cent	900
Cost of equipment	85,000
Depreciation of equipment 5 per cent	4,250
Taxes 1 per cent	1,250
Total fixed charge yearly	13,900
Fixed charge per month	1,158.33

1000 Ton Monthly Report Melting Furnaces Pulverized Coal

Iron melted, tons	1,800
Number of furnaces	4
Number of heats per day, per furnace	2
Number of days per month	22
Number of heats per month	88
Average size of heat, tons	204
Melting time first heat, hours	7.6
Melting time, second heat, hours	7.0
Melting ratio	3.8
Coal used, tons Kentucky slack	472.4

OPERATING LABOR

One-half of fuel house labor per day equals 7.50 per day. 30 X 7.50 equals $225.00. Two men at each furnace 12 hours per day at 55c and 50c equals $25.20 per day. 22 X $25.20 equals $554.40. $554.40 + $225 ..... $779.40

POWER PREPARING COAL

	K. W. H. per ton coal
Coal feeder	1.073
Crusher	.212
Elevator	.191
Belt screw	1.150
Magnet	.475
Dryer	1.008
Cross screw	.619
Pulverizer	17.800
Exhauster	2.112
	23.640

23.64 X 472.4 equals 11,167.6 K. W. H. used in preparing coal.

POWER TO DISTRIBUTE COAL

	K. W.
Average load feed screw	3
Average load blower	32
Average load booster	32
	67

330 X 67 equals 22,110 K. W. H. used in distributing coal.

	K. W. H.
Average time per day—15 hours	11.167.6
22 X 15 equals 330 hours running time	22,110.0
Total power consumed	33,277.6
Power cost @ $2.25 equals	$746.75
Power cost @ $1.75 equals	$582.36

Secondary air and blast not charged to P. C. as these units were used on hand furnaces.

MAINTENANCE

Bricklayer at $120 and helper $90 charged to melting equals ½ X (120 + 90) equals $105.

Brickwork side walls same as for hand fire. Bungs last 24 heats. Bungs take 1088 brick per furnace,
Total heats, 88 ÷ 24 equals 3.66 times that bungs are renewed.
Brick at $59 per 1000.
3.66 X $59 X 1.088 equals 234.94 cost of brick
105.00

339.94 Maintenance cost

COAL COST

Coal per ton at mine, Kentucky slack	$1.50
Freight	3.15
Tax	.095
Unloading	.025
Total cost per ton to ground	$4.770
Coal used, tons	472.4

Total cost to ground ($472.4 X $4.77) equals $2,253.00.

COST OF CHARGE

Make up of charges for year 1919 using hand fire compares with 37 heats using pulverized coal, year 1919—Hand fire.

	Mall. Pig	Spruc	Mall. Scrap	Steel	Total
Pounds	9,155,900	4,591,600	1,582,500	850,900	16,180,900
Per cent	55.7	28.4	9.7	5.2	100
AVERAGE OF 37 HEATS P. C.					
Pounds	752,000	526,840	226,500	66,650	1,753,310
Per cent	47.8	32.4	14.4	4.2	100

Or a saving of 8.9 per cent in malleable pig which is replaced by malleable scrap.
160.2 at $21 equals $3,364.20
56.7 X 1800 equals 1020.6 tons 160.2 at $12 equals 1,922.40
47.8 X 1800 equals 860.4 ..... 1,441.80 saving

150.2 tons per month on charge.

SUMMARY

Cost of coal to ground	$2,253.35
Cost operating labor	$ 779.40
Cost, power	$ 748.75
Cost, maintenance	$ 339.94
Cost, oil, grease, etc	8.22
Cost, fixed charges	579.16
Cost, coal used by dryer equals (1.3 X 472.4 X 4.77) equals	29.29
Total	$4,738.11
Saving in charge 8.9 per cent	1,441.11
Total, net cost	$3,296.31
Cost per ton of iron	1.83
Cost per ton of coal	6.97

Comparison Pulverized Coal and Hand Fired

	Pul. coal	Hand fire
Iron melted, tons	1,800	1,800
Kind of Coal	Ky. slack	Ky. lump
Melting ratio ½	3.80	3.42
Coal required	$ 472.4	$ 526.3
Number of days running	22	22
Total number of heats	88	88
Average size of heats, tons	20.4	20.4
Melting time, first heat, hours	7.6	9.6
Melting time, second heat, hours	7.0	7.0
Power cost per K. W. H.	$ .0225	.....
Total cost of coal to ground	$2,253.35	$3,128.85
Total operating labor cost	779.40	1,293.60
Total cost, power	748.75	.....
Total cost, maintenance	339.94	458.06
Total cost, fixed charges	579.16	.....
Total cost, oil, grease, etc.	8.22	.....
Total cost, coal used by dryer	29.29	.....
Total	4,738.11	4,880.51
Saving in cost of charge	1,441.80	.....
Total net cost per month	$3,296.31	$4,880.51
Cost per ton of iron melted	1.83	2.71
Cost per ton of coal	6.97	9.27

be made for excessively wet coal. The temperature is regulated by a recording thermostat. About 30 pounds of coal is required to dry a ton sufficiently for pulverizing. However, this is not a loss or an expense, for, if the coal were fired wet it would take the same amount to drive off the excess moisture before combustion could take place.

After the coal is dry it leaves the dryer and is conveyed, by an enclosed feed screw, *A*, Fig. 1, to the crushed coal bin, *B*. This bin holds approximately one ton of dry, crushed coal. From this bin the coal is fed to a feed screw, *C*, which delivers it at a uniform rate to the pulverizing mill, *D*. This pulverizing mill consists of four steel balls, about 10 inches in diameter, running in a cast steel race. These balls quickly reduce the coal to a fine powder.

Directly above the pulverizing mill, and connected to it, is a cyclone collector. When the coal has been reduced to the required fineness, it is lifted into the collector by an exhaust fan. The fineness of the coal may be regulated by adjusting the size of the opening to the collector and regulating the speed of the exhauster.

The pulverized coal leaves the collector and enters a storage bin supported above all other equipment. This bin holds about 25 tons of coal.

Table II

1000 Ton Monthly Output Annealing Ovens Hand Fired

Output of castings, tons		1,000
Number of days running		30
Average number of ovens under fire		6
Iron to coal ratio		202
Coal returned, tons		495.04
Number of fires		12
Number of firemen, 12 hours per day at 50 cents		2
Number of coal wheelers, 12 hrs. per day at 40 cents		2
Number of ash wheelers, 12 hrs. per day at 35 cents		1
Operating labor per 24 hours		25.80
Firemen—2 X 12 X 50 cents equals	12.00	
Coal wheelers—2 X 12 X 40 cents equals	9.60	
Ash wheelers—12 X 35 cents equals	4.20	
Operating labor per month	25.80 X 30	774.00
Ovens coming up, hours		64
Ovens loading, hours		12
Ovens holding, hours		72
Total hours fired		156
Ovens, coming down, hours		48
Ovens, unloading		12
Total hours for annealing cycle, hours		228
Operating labor per ton iron		$ .774
Operating labor per ton coal—$.774—$495.04		1.56
Cost of coal per ton to ground		5.945
Total cost of coal—$495.04 X $5.945		2,943.01
Operating labor		774.00
Total cost of coal into fire		$3,717.01
Maintenance, labor ½ bricklayer at $120 and ½ helper at $90 equals $60 + 45		105
Maintenance, 100 brick per year at $59 X 6 equals		35.40

SUMMARY

Total cost of coal	2,943.01
Total cost of operating labor	774.00
Total cost, maintenance	140.40
	$3,847.41
Cost per ton of iron	3.86
Cost per ton of coal	17.79

1000 Ton Monthly Output Annealing Ovens Pulverized Coal

Iron annealed, tons		1,000
Time ovens coming up, hours		24
Time ovens holding, hours		60
Total firing time, hours		84
Time ovens coming down, hours		48
Time loading and unloading, hours		24
Total hours to turn oven over		156
Coal required, tons, Ky. Slack		280.1
Hours saved 228—156=72. 72÷228		31.6 per cent
Capacity of annealing room increased		31.6 per cent
Or 100 tons could be put through in 30		20.52 days
Coal to iron ratio		3.57
Coal cost to ground—280.1 X 4.77		1,336.07

OPERATING LABOR

At ovens, 1 man 24 hrs. per day at 40c = $9.60	
20.52 X 9.60	196.99
Fuel hous, ½ charged to annealing. (2 men days at $5, 1 man nights at $5) = $7.50 per day.	
30 X 7.50	225.00
Total = $225 + $196.99	421.99

POWER

	K. W. H per ton coal
Coal feeder	.073
Crusher	.212
Elevator	.191
Belt screw	1.150
Magnet	.475
Dryer	1.008
Cross screw	.619
Pulverizer	17.800
Exhauster	2.112
To prepare coal	36.640

Total power to prepare coal 13.64 X 280.1 ..... 6621.56 K. W. H.

POWER TO DISTRIBUTE COAL

Total number of hours running—20.62 X 24 =	$ 492.49
	K. W.
Average load of feed screw	3
Average load of blower	32.5
Average load of booster	32.5
Average load of sec. air	5.5
	73.5

36,198.3 + 6,621.56 = 42,819.86 K. W. H. Total power
Power cost at $2.25 = 963.45
Power cost at $1.75 = 749.35
73.5 X 492.48 = 36,198.3 K. W. H. to distribute coal

MAINTENANCE

Bricklayer at $120 and helper at $90 ½ charged to ovens equals $105 per month.

Oil, grease, etc.	8.22
Coal used by dryer, 1.3010—280.1 = $4.77	17.36

SUMMARY

Coal cost to ground	1,336.07
Cost, operating labor	421.99
Cost, power	963.45
Cost, oil, greases, etc.	8.22
Cost, maintenance	105.00
Cost, fixed charges	579.15
Cost coal used by dryer	17.36
	3,431.25
Cost per ton of iron	3.43
Cost per ton ton of coal	12.24

Comparison Pulverized Coal and Hand Fired

	Pul. Coal	Hand Fire
Iron annealed, tons	1,000	1,000
Number of days firing	20.52	30
Coal	Ky. slack	Ky. slack
Iron to coal ratio	3.57	2.02
Coal cost per ton to ground	4.77	5.945
Hours ovens coming up	24	84
Hours ovens holding	60	72
Total firing time	84	156
Ovens coming down, hours	48	48
Ovens loading and unloading	24	24
Total hours to turn oven over	156	228
Time saved, per cent	31.6	.....
Power cost, per K. W. H.	$ .0225	.....

	Pul. coal	Hand fire
Coal used, tons	280.1	495.04
Total cost of coal to ground	$1,336.07	$2,943.01
Total cost operating labor	421.99	774.00
Total cost power	963.45	.....
Total cost maintenance	105.00	140.04
Total cost fixed charges	579.15	.....
Total cost, oil, greases, etc.	8.22	.....
Total cost coal used by dryer	17.36	.....
Total	$3,431.25	$3,857.41
Cost per ton of iron	3.43	3.85
Cost per ton of coal	12.24	7.79

Table III

1000 Ton Monthly Output Recapitulation

	Pulverized coal	Hand fire
Total investment	$125,000.00	.....
Monthly fixed charge	1,158.16	.....
Iron melted, tons	1,800.00	1,800.00
Iron annealed, tons	1,000.00	1,000.00
Melting ratio	3.80	3.42
Coal to iron ratio, annealing	3.57	2.02
Coal used, melting, tons	472.4	526.30
Coal used, annealing, tons	280.1	495.04
Total coal used	752.5	1,021.34
Coal used per ton to ground	4.77	5.945
Operating labor cost per ton coal	1.50	.....
Power cost per ton coal	2.27	.....
Fixed charges per ton coal	1.54	.....
Power cost per K. W. H.	.0220	.....
SUMMARY		
Total cost of coal to ground	$3,589.42	$6,071.86
Total cost operating labor	1,201.39	2,067.60
Total cost power	1,712.20	.....
Total cost maintenance	444.94	598.46
Total cost fixed charges	1,158.16	.....
Total cost oil, grease, etc	16.44	.....
Cost coal used by dryer	46.65	.....
	$8,169.20	$8,737.92
Saving in charges 8/9 1/10	1,441.80	.....
Total net monthly cost	$6,727.40	$8,737.92
Cost per ton of castings	6.73	8.74
Coal to iron, ratio	.752	1.02
Cost per ton of coal	8.94	8.55
Saving per month	$2,010.52	.....
Saving per year	24,126.24	.....
Years required to pay for self	5.2	.....

It is provided with a vent through the roof which acts as a safety valve, permitting any gas, which may accumulate, to escape. Great care must be taken to prevent any moisture from entering this bin, or sulphuric acid will form in the bottom, which under pressure of the coal above, will cause spontaneous combustion to take place.

There are two distinct distributing systems, one known as the melting furnace line, the other the annealing line. The melting furnace line is an open line without a return. All of the coal entering this line is burned at the melting furnace. The annealing pipe line is a complete circuit, connecting all of the annealing furnaces. In this line there is a continuous flow of coal; the coal which is not burned, returns to the fan and again enters the circuit.

However, in both systems the mechanical arrangements are similar. The coal leaving the pulverized coal bin, *A*, Fig. 2, is fed to its particular fan by a feed screw, *B*. The high pressure blower, *C*, forces the coal through the long annealing circuit, while only a low pressure blower, *D*, is required for the melting line. The speed of these blowers, and their respective feed screws, determines the amount of coal delivered to the burners. This speed is regulated by rheostats, located at the melting and annealing furnaces, thus controlling the speed of the respective motors.

The amount of coal delivered per revolution of the feed screws is determined by actual test. Revolution counters, *E*, indicate the daily number of revolutions of each screw, thus recording the actual amount of coal used daily, in melting and annealing.

In this particular installation the melting furnaces were of the hand fire, air-furnace type. Little change in their design was necessary to adapt them to pulverized coal. The bridge wall, between the fire-box and the bath, was removed and the grates covered with brick and sand. This increased the size of the bath for melting. Two burners, *B*, Fig. 3, were placed in the end of each furnace as shown.

These burners are made of heavy cast iron. The pulverized coal enters

(*Concluded on Page* 832)

FIG. 5—MAIN VIEW OF THE FOUNDRY SHOWING TH E MELTING FURNACES AND CHARGING CRANE

Casting Railroad Bearings--II

By G. H. Clamer

FIG. 5—JOURNAL BEARINGS ARE LINED WITH BABBITT OR WHITE METAL

SINCE wear means the tearing off of small particles, the greater the resistance of such particles to the tearing force, the slower should be the rate of wear. Of all the alloys tested, those exhibiting the lowest ductility, whether hardened with tin alone or with tin and zinc, indicated the greatest rate of wear. The particles are split more rapidly and detached from the worn body. In the more ductile alloys, the particles of the worn body present greater resistance to the tearing force, consequently the alloy wears more slowly. This general theory regarding wear is naturally only true under conditions of normal wear; where the bearing as a whole does not suffer actual deformation under the load or thrusts of service, also when no foreign matter is present in the lubricating film. Theoretically, under conditions of perfect lubrication, there can be no actual contact between the journal and the bearing. The wear is occasioned entirely by fluid friction. However, actually this does not seem to be the case, because there is much evidence to show that the material of the journal, as well as the material in the bearing, exerts an important influence is manifested by the coefficient of friction with its effect upon the temperature of the lubricant, and also on the actual rate of wear on the journal and the bearing. If this were not a fact, fully recognized in practice, the cheapest material possible, cast iron, would be used almost universally for bearings of all machinery.

Exchange Paper

In this, the second part of the American Foundryman's association annual exchange paper presented by G. H. Clamer before the Association Technique de Fonerie de France, the author discusses the qualities of the various alloys in use and compares the theoretical lubrication theory with the actual working conditions to which the bearings are subjected. The text is illustrated with several tables based on experiments conducted by the majority of the railroads to determine the alloy best suited to their requirements. The hope is expressed that eventually one set of specifications will be accepted as standard on all railroads.

If it were actually possible to maintain in service theoretically correct surface adjustments and theoretically perfect lubrication, perhaps the service performance would be independent of the nature of the material of the journal and of the bearing.

Chilled metal was required to make perfectly dense test pieces that would absorb the minimum amount of oil under the pressure conditions used on the testing machine. The alloys carefully prepared were poured into open iron ingot molds. The test pieces were cut from the lower portion of the ingot. Tensile and compression tests were made on test pieces also cut from the lower portion of the ingot directly adjacent to the test pieces used for the wear and friction tests.

Table V shows the 26 alloys tested, giving their composition, limit of elasticity, compression under 100,000 pounds, tensile strength in pounds per square inch and per cent of elongation.

All the alloys shown in Table No. V were not subjected to wear and friction testing. The curves indicating the performance of the alloys when subject to compression strains are shown in Fig. 8.

The compression and tensile tests indicate quite clearly the relative value of the various alloys for the backs of car journal bearings in resisting the loads and thrusts encountered in service. The alloy with the necessary tensile strength and the greatest elongation will be less likely than others to fail in service due to breaking of lugs, breaking of collar, or cracking

Table III

Journal Bearing Specifications Adopted by Many Railroads

Composition of Bronze Backs

Railroad	Adopted or revised	Special No.	Lead	Tin	Copper	Other Elements	Iron (max.)	Zinc (max.)	Max. Total Impurities
A. R. A.	1923		16-24	5-7	67-77				4
A. S. T. M.	1921	B17-21T	17-22	4-6	Remainder	.5(a)	.4	2.5	3
A. C. L.	——		15	9	73			3.0	
B. & L. E.	1920	116B	16-24	5-7	67-77				4
B. & O.	1923	12J	16-24	5-7	Balance			3	4
C. & A.	1911	53	10-14	7-10	75-80				1
C. M. & St. P.	1922	115D	16-24	5-7	67-77				4
C. R I &	1920	581 Pass.	20-22	4.5-5.5	70-72			3.5	.75 (d)
C. R. I. & P.	1920	581 Frt.	19-23	4-6	69-72			4.0	.75 (d)
C. & N. W.	1921	B17-21T	17-22	4-6	Remainder	.5 (a)	.4	2.5	3
C. & O.	1922	15B	13-16	7-9		.15-.50 (e)			1
D. L. & W.	1919	500	14-20	5 Min.	72 Min.				3
Erie	1921	434E	20-28	5 Min.	72 Max.				3
F. G. E.	1921	2T	26 Max.	4 Min.	65 Min.				3
F. E. C.	1923	5H	16 Max.	7 Min.	——				1½
G. N.	1917	ME-23-24	9-12	9 Min.	72-80			2.5	1(d)
I. C. R. R.	1920	27M	10-15	6-10	75-80			5	1 (d)
L. & N.	1922	423A	14-16	7-9	Over 74				1
Nor & So.	1923	502	18-22	4-6	68-72				3
N. & W.	1924	71E	16-24	5-7	67-77				4
N. Y. C.	1922	M53	16-24	5-7	67-77				3
N. P.	1923	M121A	16-24	5-7	67-77				4
P. R. R.	1917	141-57	13-16	7-9		.15-50 (e)			1
R. F. & P.	1923	MP-4-23	16-24	5-7	67-77				4
Southern	1911	6D	Balance	4-10	65-75				2
So. Pac.	1922	CS-12-A	16-24	5-7	67-77				4
Seaboard	1919	91	18-22	4-6	68-72				3
Union Pac.	1921	CS-63	16-24	5-7	67-77				4
Wabash	1924	LC-240	10-16	Over 6	Over 75			3	1 (d)
Western Md.	1920	12A	16-24	5-7	Balance			3	1 (d)
W. & L. E.	1924	CL-301-B	16-24	5-7	67-77	——			4

(a) Antimony Max. (b) Copper Max. (Impurity) (c) No iron and no zinc (d) Max. other impurities (e) Phosphorus.

Composition of Lining

	Tin	Antimony	Antimony plus tin	Lead	Arsenic (Max.)	Other Elements	Max. Total other impurities
A. R. A.	3-5	8-10	12-14	85-88	.2		.5
A. S. T. M.	4.5-5.5	9.25-10.75		Remainder	.2	.5(b)	.75 (c)
A. C. L.							
B. & L. E.	3-5	8-10	12-14	85-88	.2		.5
B. & O.	6-8	9-11		84 Max.			.75
C. & A.	4	16		80			
C. M. & St. P.	3-5	8-10	12-14	85-88	.2		.5
C. R. I. & P.	4.5-6.5	9-11		83-86			.75
C. R. I. & P.		15-17		83-85			.75
C. & N. W.	4.5-5.5	9.25-10.75		Remainder	.2	.5 (b)	.75 (b)
C. & O.	2 Max.		12-14	86-88		.5 (b)	.5
D. L. & W.	4.5-5.5	9-11		84-86			.75
Erie			12-14	86-88			.75
F. G. E.	5	10		85			
F. E. C.							
G. N.	5-7	13-15		78-82			
I. C. R. R.		14-18		82-86			1
L. & N.	4-6	9-11		Over 82			.75
Nor. & So.		15		85			
N. & W.	3-5	8-10	12-14	85-88	.2		.5
N. Y. C.	3-5	8-10	12-14	85-88	.2		.5
N. P.	3-5	8-10	12-14	85-88	.2		.5
P. R. R.	Under 2		12-14	86-88		.5 (b)	.5
R. F. & P.	3-5	8-10	12-14	85-88	.2		.5
Southern	1	4		95			
So. Pac.	3-5	8-10	12-14	85-88	.2		.5
Seaboard		15		85			
Union Pac.	3-5	8-10	12-14	85-88	.2		.5
Wabash	1	10		89			
Western Md.	1-2	12-14		84-87			.75
W. & L. E.	3-5	8-10	12-14	85-88	.2		.5

(a) Antimony Max. (b) Copper Max. (Impurity) (c) No iron and no zinc (d) Max. other impurities (e) Phosphorus.

Table IV

Bearing Metal Used in French Railroads

Designation of Alloys	Uses	Composition	Normal	Minimum	Total Minimum	Per Cent of Impurities Max.	Limit
Bronze B 1	Faucets Stopcocks	Copper	90	87			0.5 max. Iron
		Tin	8	7	95	5	0.3 max. Nickel
		Lead	2	1			1.5 max. Lead
Bronze B-2	Parts subject to Friction	Copper	86	84	98	2	0.5 max. Iron
		Tin	14	12			0.3 max. Nickel
Bronze B-3	Parts very Resistant to Friction and Crushing	Copper	85	84			
		Tin	12	10			0.5 max. Iron
		Zinc	2	1	98	2	0.3 max. Nickel
		Phosphorus	0.3	0.15			
Bronze B-4	Certain Brasses	Copper	77	75			
		Tin	8	7	98.5	1.5	0.5 max. Iron
		Lead	15	14			1 max. Nickel
White Bronze or German Silver	Accessory Parts of Cars	Copper	62	59			
		Zinc	20	16	98.5	1.5	0.3 max. Iron
		Nickel	18	16			
Brass (L1)	Accessory Parts of Cars and various articles	Copper	67	64			
		Zinc	33	30	97	3	0.3 max. Nickel
							1 max. Iron
							1 max. Lead

of the bearing.

As car journal bearings are said to operate normally at 100 to 120 degrees Fahr., and under conditions of improper adjustment or with foreign matter in the lubrication at higher temperatures, the alloy used should be one that retains at elevated temperatures as nearly as possible its normal physical properties. All the alloys referred to in the series of tests, Table III and particularly all those alloys commonly in use, retain under hot box conditions but a fraction of the tensile strength they possess at atmospheric temperatures. Bearings fail under hot box conditions not only because of the de-structure of the bearing surfaces, but also because of lack of strength at the elevated temperatures.

Railway Bearing Specifications

In the United States two national associations, the American Society for Testing Materials and the American Railway association have adopted specifications covering car and locomotive journal bearings. The specifications of these two associations are sufficiently close to warrant the hope that soon they will be brought into harmony. Concerted efforts in this direction now are being made, and it is hoped that within the next year or two, a uniform specification will be adopted, acceptable to all railroads operating within the confines of the United States and Canada.

The American Railway association is an association of railway engineers only and therefore, is a consumer in respect to the purchase and use of car and locomotive journal bearings. The American Society for Testing Materials has on its standing committees for the formulation of specifications, representatives of the manufacturer as well as representatives of the consumer. Several unattached experts also are members of these committees. Subcommittee VI of committee *B*-2 of the American Society for Testing Materials, of which the author has been chairman since its formation, is composed of representatives of the railways as well as representatives of the manufacturers and unattached experts. The consuming interests, together with the unattached experts, constitute a majority of the committee.

Notwithstanding the standard specifications of the two national associations, many railways continue their old practice of purchasing castings or manufacturing them in their own shops under individualistic specifications.

William K. Frank, vice president, Damascus Bronze Co., Pittsburgh, recently made a survey of the specifica-

tions in use, and kindly has compiled for my use in this paper the data given in Table III.

An examination of this table reveals that a majority of the railroads have adopted the American Railway association specifications, or have modified them only to some minor extent. None of the specifications differ widely in composition and certainly little difference has been noted in service performance. The specifications of the American Railway association and the American Society for Testing Materials, and the specifications of all the large railway systems listed, surely are sufficiently close to condemn the almost criminal waste apparent under past conditions. Many economic advantages are at once apparent as the result of absolute and universal standardization.

Even at a conservative estimate of 10 cents a pound the 590,968,740 pounds of bearing metal in use on the railways of the United States represents a capital investment of $59,096,874. The compositions of the bearings in service have been found by analyzing many millions of pounds of melted scrap, to fall quite consistently within the range of the specifications of the American Railway association. A great economic consideration is involved in having a specification sufficiently liberal in its limits of main constituents, and the total impurity content, including zinc, to permit of the direct use of a large proportion of returned scrap. Previous to the World war, a large number of the railways of the United States had specifications that did not permit of the economic use of scrap. During the war period the United States Railroad administration called a meeting of a special committee to consider the subject of the economic use of scrap in the manufacture of new bearings. The present American Railway association specifications are largely a result of that meeting.

Table V

Physical Properties of Bearing Alloys

No.	Cu.	Sn.	Pb.	Zn.	Limit of Elas.	Comp. under 100,000 lbs.	Tensile	Elong.	Remarks
1	90	10	..	..	25,000	26	39,000	15	.....
2	85	10	5	..	22,000	26	32,750	9½	.....
3	80	10	10	..	23,000	29	31,850	8½	.....
4	75	10	15	..	23,000	32	27,000	6	.....
5	70	10	20	..	21,000	..	27,000	6	Sheared at 81,500 lbs.
6	80	10	5	5	27,000	21	33,550	3.5	.....
7	75	10	10	5	28,500	22	31,300	2½	.....
8	70	10	15	5	26,000	..	30,000	4¾	Sheared at 93,400 lbs.
9	75	10	5	10	27,000	19.5	24,400	1.0	.....
10	70	10	10	10	29,000	17	28,100	1½	.....
11	70	10	5	15	40,000	17	27,500	1.5	.....
12	95	5	..	..	18,000	.31	41,800	34.5	.....
13	90	5	5	..	19,000	.32	40,500	34.5	.....
14	85	5	10	..	18,000	.365	31,200	19.5	.....
15	80	5	15	..	16,000	.390	23,300	15.5	.....
16	75	5	20	..	15,000	..	23,300	15.5	Sheared at 89,400 lbs.
17	70	5	25	..	16,500	..	24,750	14.0	Sheared at 67,300 lbs.
18	65	5	30	..	15,000	..	19,800	12.0	Sheared at 61,150 lbs.
19	85	5	5	5	18,000	.33	38,150	36	.....
20	80	5	10	5	16,000	.34	34,700	23	.....
21	75	5	15	5	18,500	..	31,350	19	Sheared at 96,300 lbs.
22	70	5	20	5	17,500	..	28,100	20	Sheared at 84,800 lbs.
23	80	5	5	10	18,000	.32	28,100	15	.....
24	75	5	10	10	19,000	.32	29,800	13.0	.....
25	75	5	5	15	17,000	.28	27,000	10	.....
26	70	5	10	15	18,500	.30	28,400	10.0	.....

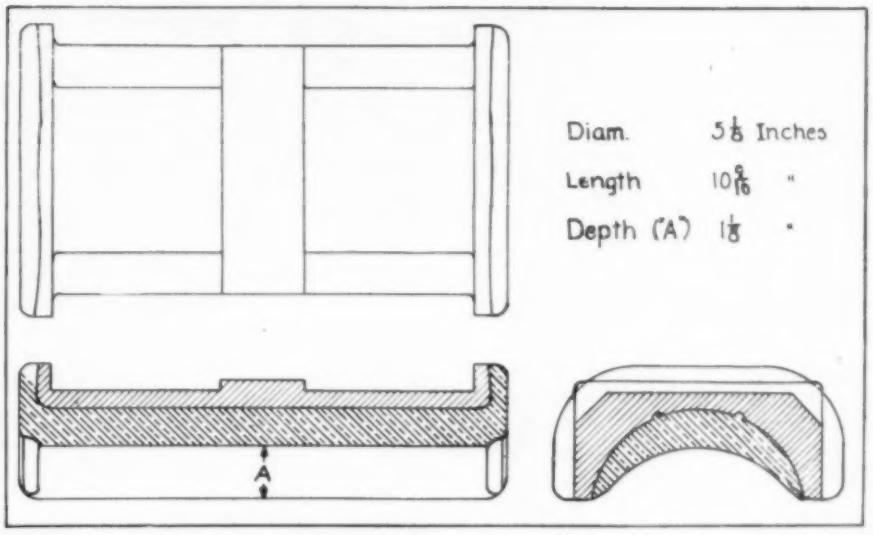


FIG. 6—TYPICAL FRENCH RAILROAD BEARING WITH BRONZE BACK AND SOFT METAL LINING

Practice In France

Through the courtesy of your esteemed President, Emile Ramas, I was supplied with information in connection with the technical specifications for white metal alloys and brass and bronze alloys in use by the French railway system. This data is presented in Tables IV and VI.

Although the information is not entirely definite, the author believes that *Bronze B-4* is the alloy chiefly used

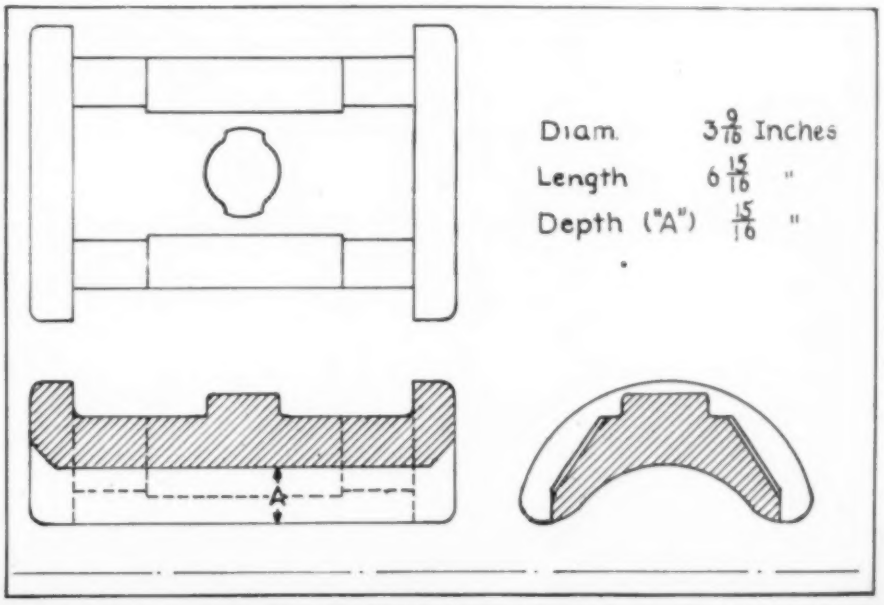


FIG. 7—ONE OF THE SMALLER BRONZE BEARINGS USED ON FRENCH ROLLING STOCK

for the backs of journal bearings. This alloy is the same composition as that known as *EXB*, used for many years on the Pennsylvania railroad in the United States. It is a good alloy for the purpose, but owing to the higher tin, lower lead and lower impurity limits is more expensive than the American Railway association alloy used for the same purpose.

The white metal alloys tabulated show three lead base alloys and two tin base alloys. The writer is aware that some years ago a tin base alloy, *AE*[1] was used for car journal bearings. This probably no longer is used, one of the lead base alloys having been substituted.

Mr. Ramas also has forwarded to me drawings showing the various types of journal bearings used in France. It would seem that there has been no definite standardization of patterns attempted by the French Railway systems. Two typical bearings are indicated in Figs. 6 and 7. Some of the French bearings are lined with white bearing metal and some are not. Those bearings with white metal linings are quite different from those used in American practice in that the lining metal is much greater in proportion to the bronze back.

In the French bearings in which white metal is used, the thickness of the lining, measuring through the crown, is greater than the thickness of the back, as shown in Fig. 6. This type of bearing is similar to the bearings that were in use in the United States many years ago and designated filled bearings.

Electric energy now provides 70 per cent of all the power consumed in the United States. Due to the electrification of machinery the use of electricity is rapidly increasing. In 1919, the consumption was 55 per cent and in 1914, 40 per cent .

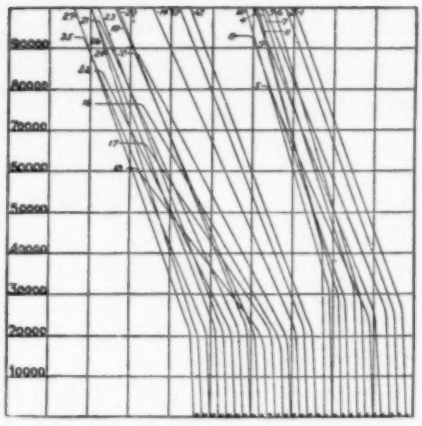


FIG. 8—COMPRESSION CURVES ON THE ALLOYS SHOWN IN TABLE IV

Malleable Furnace Uses Pulverized Coal

(*Concluded from Page* 828)

through the pipe, *A*. This coal is mixed with air from the primary blower, but not enough air is provided in this way to maintain combustion. The necessary additional air is supplied by a pressure blower, located in the foundry. It enters the burner through the pipe, *C*. The amount of air and coal delivered to the burner is controlled by butterfly valves. This mixture is adjusted, by increasing or decreasing the coal or air, until perfect combustion results. The burner flame then shows no smoke or excess coal. The interior of the furnace is filled with a perfect reducing flame, and no smoke leaves the stack. After the burners are adjusted little attention is given them.

No top blast was necessary with these furnaces, although top blasts were used on the larger furnaces and found to give good results. A 25 ton heat can be melted in four hours.

Altering the annealing furnaces was more difficult and expensive, as they were in poor condition and low. The height was increased and the fire-boxes removed, thus increasing the annealing space. These annealing furnaces were of the double type, being about 25 feet square and 7½ feet high at the center, inside. One burner was placed in each half, entering through the rear wall as shown in Fig. 4. The pipe *A* is the feedline for the coal while *B* is the return line. Pipe *E* is the secondary air line, carrying air from the small blower, located in the annealing room, to the burners. The air from *E* and coal from *F* mixes at the burners *H*. The correct proportion of air and coal is regulated by a gate valve in the coal line and a butterfly valve in the air line.

There are four flues in each half of the annealing furnaces. These flues are located in the corners and are regulated by dampers at the rear, which are operated by winding drums, shown at *K*. It is possible to control the temperature of the annealing furnaces closely throughout with these dampers, giving a uniform distribution of heat to all points.

The temperature of the annealing furnaces is regulated by a pyrometer system, the thermocouples being located at various points in the furnace. A regular cycle for bringing the furnaces up to the annealing temperature, soaking and cooling, is furnished the operator. A check of each oven is made each day by an automatic, recording pyrometer.

A careful study of the comparative data, in the accompanying tables, covering melting and annealing, using pulverized coal and the hand fired methods, will show the financial advantage of pulverized coal. While it is true that the first cost is large, the results show that the system soon pays for itself in the convenience and flexibility of operation, its dependibility, and the quality of the product produced.

Table VI

Soft metal linings for French Railroad Bearings

Designation of Alloys		Composition	Normal	Minimum	Total Minimum	Per Cent of Impurities Max. Limits
Lead Base	AP[1]	Lead	96	95	99	1
		Antimony	4	3		
	AP[2]	Lead	85	84		
		Antimony	10	9	99	1
		Tin	5	4		
	AP[3]	Lead	80	79	99	1
		Antimony	20	19		
Tin Base	AE[1]	Tin	83	82		
		Antimony	11	10.5	99	1
		Copper	6	5.5		0.5 max. Lead
	AE[2]	Tin	80	79		
		Antimony	12	11	99	0.5 max. Lead
		Copper	7.7	7		
		Phosphorus	0.3	Trace		

Discusses Welding

A booklet just issued by the Chicago Steel & Wire Co., Chicago on the properties of steel filler rods for gas and electric welding rods contains much valuable data for the users of welding rods. The need for a line of filler rods standardized in all properties has lead to the development of the data contained in the pamphlet. Causes of weld failures are discussed and the remedies given with reference to the type of filler rods used. Heat treating of the rods receives some discussion, and the results of analytical tests on both gas and electric rods are described.

How and Why in Brass Founding

By Charles Vickers

Mixture Is To Blame for Faulty Matchplates

We have been trying to make aluminum matchplates for use in our stove grate trade, as we desire to displace our present cast iron plates. So far we have been unsuccessful and are sending you a sample cut from one of the plates so you may form an idea of our difficulty. As you will note the plates come smooth on one side, the cope side, but the drag side is full of defects caused by a peculiar condition of the surface. The mixture used on the sample is aluminum 2 parts; zinc 1 part, and 5 per cent copper added. We also have tried with the same results aluminum 3; zinc 1; also with 5 per cent copper, and have even replaced the copper with tin, with no better results. The molds are skin dried, and the metal is melted in crucibles in natural draft furnaces, the aluminum and zinc being melted together, the copper separately and then poured into the fluid aluminum-zinc mixture. We have tried fast pouring, slow pouring, hot pouring and cool pouring, all with the same results. As we are so far away (Australia) we will appreciate your advice by letter if possible, as the time is a great consideration.

The difficulty is caused by the unsuitable mixture of aluminum that is being used, and nothing that can be done in the way of skin drying, changing molding methods, and methods of pouring, such as varying the rate of pouring, the temperature of the poured metal, or the method of melting or of mixing the alloy will have the slightest effect in lessening the difficulty. We suggest that a medium fine grade of sand be used, the molds can be skin dried if preferred as the aluminum makes better castings when it lies quietly against the sand and does not shiver. The practice to be changed is the method of making the alloys, and the alloys themselves. The alloy of 2 parts aluminum; 1 part zinc, with 5 per cent copper, figures in percentages, aluminum 63.81 per cent; zinc 31.42 per cent; copper 4.77 per cent. The alloy of 3 parts aluminum contains too high zinc to be used for making matchplates. We suggest the following alloy: aluminum 92 per cent; copper 8 per cent. This alloy is known in the United States as No. 12 aluminum alloy. It is made as follows: first melt in a curcible a certain amount of copper; which when melted must not fill more than one-third of the crucible, otherwise it may overflow when the aluminum is added. Before being put into the crucible the copper should be weighed so that when it is molten an equal weight of aluminum can be added, making an alloy of 50 per cent copper and 50 per cent aluminum. The final alloy is made by melting together 84 per cent ingot aluminum and 16 per cent of the 50-50 hardener. Be careful about pouring the aluminum hotter than necessary to completely fill the mold, and make the pouring heads higher than for cast iron to get pressure, as aluminum is only around one-third the weight of iron for pieces of equal size.

Another alloy that may be used is zinc 15 per cent; copper 3 per cent; aluminum 82 per cent. This alloy is made by adding 6 per cent of the copper hardener to 79 per cent ingot aluminum and when the two are molten, stirring and adding the 15 per cent of zinc. The alloys that have been used that were too high in zinc may be converted into the 15 per cent zinc alloy and so be used up. Thus taking alloy No. 1; containg 2 of aluminum and 1 of zinc, by melting 48 pounds together with 1½ pounds of the 50-50 hardener, and 50½ pounds ingot aluminum, the alloy with 15 per cent zinc will result which is near enough for all practical purposes. If zinc is used with the alloy containing 8 per cent copper, the latter must be reduced.

Gives Information on Titanium Bronze

Will you be so kind as to furnish us with whatever information you have concerning titanium bronze?

Titanium bronze or titanium copper is an alloy of varying constituents. When copper is alloyed with titanium pure enough to be called titanium, it is silvery when cut, but oxidizes to a copper hue on the cut and polished surfaces. The titanium has to be obtained by reduction of the tetrachloride by sodium, conducted in a bomb of great strength. The reduced titanium resembles steel in appearance, and it alloys with copper at the melting point of the latter, the alloy being easily made in a brass melting furnace fired with coke. The alloy cannot be cast because only the eutectic pours out of the crucible, so that about 65 per cent of the metal is lost in a pasty state. Temperature has no effect on increasing fluidity, neither has aluminum or any other element known commercially. The alloy has been used to deoxidize copper, but it works in an erratic manner, and when the castings are solid, on turning off, they will be filled with black specks of oxide.

Another titanium copper is made in the electric furnace and the rutile being aluminum reduced. The alloy contains more aluminum than it does titanium. Skilled operators have made it with a little less aluminum than titanium, but others who have tried such reduction, got only an alloy of from 15 to 30 per cent aluminum with 5 to 6 per cent titanium. By using a modified thermit reaction the writer has made such an alloy of around 10 per cent titanium with from 3.5 to 5 per cent aluminum. None of these alloys have any commercial application, as they cannot be cast, and if extruded the metal will be filled with nitrides, oxides and carbides and will be valueless unless made in an atmosphere neutral to titanium. As deoxidizers of nonferrous metals such alloys are of no value, although in conjunction with a little aluminum, such an alloy, for instance as titanium 12 per cent; aluminum 10 per cent; the remainder copper, with impurities such as iron, etc.; is exceedingly hard and quite strong.

We believe, therefore, there is a mistake about titanium bronze, that what is meant is titanium aluminum bronze, something entirely different to the alloys above mentioned. This is an aluminum bronze devised by the writer around 1914. Titanium aluminum bronze contains copper 89 per cent; iron 1 per cent; aluminum 10 per cent; and the name comes from the fact that the alloy is de-

oxidized with a degasifying alloy that contains a small amount of titanium, the proportion of which was determined as the result of dozens of experimental tests. The tensile strength of this alloy is about 72,000 pounds per square inch, elongation around 22 per cent and it is the weakest of the series of ferrous aluminum bronzes.

Readers Comment

Note Material appearing under this head does not necessarily reflect the opinion of The Foundry or of its editors.

Defends Vibratory Test

TO THE EDITORS:

In THE FOUNDRY, July 1, an article appeared entitled "Status of Sand Tests" presented before the Glasgow, Scotland, convention of British foundrymen, by Prof. H. Ries, Cornell University, describing tests adopted by the joint sand research committee for one year. He later refers to the vibratory test, and proceeds to give a description of the test, also conclusions arrived at by Mr. Dietert, a chemist with the U. S. Radiator Co., who has been active lately in sand research. It is unfortunate that inaccuracies should be included in exchange papers.

The following statement occurs:

"Mr. Smith has sought to show that this one simple test may take the place of all the standard ones used in foundry control."

This is not strictly true, as a matter of fact, the vibratory test was given to the Chicago Foundrymen's club as a shop *kink*, which might prove of value, accompanied by a paper showing possibilities of the test at that time. This was followed later by a request by the American Foundrymen's association to present a paper at Cleveland. The paper was given as requested, but before the paper was read, the sub-committee reported the vibratory test for the determination of silica and bond as "not dependable". This naturally served to kill the real value of the test in the minds of a great many foundrymen and readers of THE FOUNDRY, but did not prevent the writer from continuing the research, and thanks to a corps of good foundry assistants, using the vibratory test as a guide and practical sand study, losses which were considered at a minimum have been reduced in one foundry forty per cent since January 1923.

The following five paragraphs were written immediately following the Cleveland convention.

The A. F. A. tentatively accepted tests for bond, porosity, dye absorption tests of clays, etc., worked out carefully, scientifically and accurately tell the tale of the various characteristics of the sand for molding. Chemical analysis, tells the component parts and the various elements which affect the material.

The vibratory test tells the fitness of the material to the class of work to be made, with sufficient accuracy to determine the changes required each day to keep losses at a minimum.

In other words, chemical analysis and other tests deal with the construction of the material.

The vibratory test deals with the physical conditions of the material and its application in the foundry.

Excess fineness and excess coarseness of the material must necessarily be considered in all cases in accordance with the finish of the product desired. This is determined by the sieve test.

Since the action taken at the Cleveland convention, the writer has intentionally avoided writing for publication, not wishing to add to the general confusion caused by a multiplicity of ideas advanced by those now engaged in sand research.

It is the writer's desire to correct a common error, that any old bottle vibrated any old way is the vibratory test. It is self-evident that in describing the test mentioned, the professor had not read the instructions and describes it as follows:

"Recommending a one inch test tube, six inches long taking a mass of sand and water and vibrating for half an hour".

The test proposed by the writer is as follows:

Use an 8 ounce oil sample bottle, 1¾ inches in diameter by 8 inches high. Fill one quarter full of sand. Fill the bottle with clear water. Shake and wash grains thoroughly until satisfied that all clay is in suspension. Place on any form of vibrator, and assist gravity by vibrating easily at first, until a slight ring of silt is shown at the division between the silica as separable by water, and the clay or bonding material. Let it settle until the water is clear. When fully settled, measure the total, then measure the silica (include silt if present). Divide the silica by the total. This gives the percentage of silica. Subtract this figure from one hundred which will give the bond percentage.

Do not put too much sand in the bottle. Do not vibrate fine sand hard, if the sand is extremely fine use a cushion of some kind or the material will be kept in suspension. Do not use any form of chemicals. Do not take sample from one place only, it is better to add together a number of samples, thoroughly mix and then take portion for vibrating.

Vibrating the sample alone does not mean anything in the foundry unless the sand is studied each day and the changes which take place are noted. Increase or decrease the new sand as required, being governed by the daily losses. New sand changes should be made in small and measured amounts.

Mr. Dietert's conclusion that a part of the bond measured in the vibratory test is pan material does not appear to the writer as strictly correct. It would seem to indicate that the test had not been correctly made, and vibration being too heavy and held it in suspension instead of assisting gravity. The writer has specimens of sand light as flour, 90 per cent of which will pass through one hundred mesh sieve, showing five divisions in the material. Finest of French sands and Kentucky sands of the same character offer no difficulty in separation.

There is a wide difference in the values of clays as a bonding material, which is easily noticeable in the settling after vibration. Some clays are fatty or heavy like thick cream, others floculent and weak as though nature in the grinding operation had not completed her work. This need give no trouble to the foundryman who is watching his sand, but is a source of trouble to the man who don't care to bother with sand control.

The writer firmly believes that the time is not far distant when the man in the foundry will solve his own sand question and its relation to his losses by some simple and practical method, and the enormous waste each day caused by the improper use of sand or use of improper sand will cease.

EUGENE W. SMITH,
Oak Park, Ill.

Test Recommended for Sand Control

TO THE EDITORS:

My attention has been invited to comments sent Eugene Smith for pub-

lication in THE FOUNDRY regarding a paper reprinted in the issues of July 1 and 15, 1925, prepared by Dr. H. Ries for the Institute of British Foundrymen.

Mr. Smith regrets that inaccuracies such as he says he found in Dr. Ries' paper should appear in an exchange paper contributed by the American Foundrymen's association to a foreign association. Mr. Smith cites as an instance of these errors, the following comment by Mr. Ries: "Mr. Smith has sought to show that this one simple (vibratory) test may take the place of all the standard ones used in foundry control." Statements made repeatedly by Mr. Smith for publication clearly indicate his dependence on this one test for foundry control purposes. Dr. Ries did not misrepresent Mr. Smith's attitude as previously exhibited by making this comment, to which Mr. Smith's answer is that "Losses which were considered at a minimum have been reduced in one foundry 40 per cent since January, 1923. This improvement is a demonstration of Mr. Smith's acknowledged ability as a foundryman. The statement of the accomplishment contains nothing to controvert the comment by Dr. Ries, to which exception has been taken.

The only other specific inaccuracy to which Mr. Smith refers as having been made by Dr. Ries, is the latter's description of the method used in making the vibratory test. Dr. Ries said: "Briefly stated, a mass of sand and water are shaken thoroughly by hand in a test tube or bottle about 6 inches high and 1 inch in diameter." Mr. Smith in his paper entitled, "Physical Test for Foundry Sand," presented at a meeting of the American Foundrymen's association in May, 1923, perscribes the use of "a 10 or 12-ounce clear glass bottle, 1¾ inches in diameter, 6 or 8 inches high." In the paper prepared for the I. B. F., Dr. Ries said: "The suspension is then placed on a vibrator for half an hour, whereupon the grains of different sizes settle to the bottom of the tube, the coarsest on the bottom and the finest on top, presenting a beautiful series of layers. The thickness of these is measured by means of a scale, thus obtaining the percentage of several grades. The layer of finest material is classed as bond." There is no essential difference between the detailed description by Mr. Smith and the appropriately brief explanation of the Smith vibratory test, as given by Dr. Ries in his comprehensive treatise on the laboratory investigation of sands.

In the concluding portion of Dr. Ries' reference to the vibratory test, he says, "It will give an approximate idea of whether it (the sand) is running uniform or not." This is correct; likewise the statements found in the report of the joint committee on molding sand research made at the A. F. A. convention in 1923 that "the vibratory test will in certain cases, including the routine use of known sands, be of some advantage in plant control. This method provides an approximation of the proportionate amounts of fine material and grain."

It is incorrect to imply, as Mr. Smith has done in his letter, that any member of the subcommittee on tests of the joint molding sand research, which subcommittee is headed by Dr. Ries, has given careless consideration to the method of making the vibratory test, and to what is determined by it. It is equally incorrect to convey the impression, as Mr. Smith has done in his letter, that "those now engaged in sand research" lack experience in foundry practice. Dr. Ries is not a foundryman, but by his work with and for them, he has helped many who know how to distinguish between good and scrap castings.

Much credit is due Mr. Smith for the serious interest he has taken in the study of molding sands, and for the sincerity with which he advances his opinions. More credit would be accorded him if he manifested a greater degree of tolerance toward those who respect him, but who fail to find that the vibratory test does all that has been claimed for it by Mr. Smith.

The above comments are made personally, without the knowledge of anyone now acting as chairman of the joint committee on molding sand research or any of its subcommittees.

R. A. BULL,
Chicago, Ill.

Pittsburgh Foundrymen Meet

That the time is not far distant when a new figure will be found in all successful foundries who will take his place alongside of the foundry chemist, was the contention of R. R. Clark before the first fall meeting of the Pittsburgh Foundrymen's association. This gathering, which was held at the Fort Pitt hotel Monday evening, Sept. 21, was attended by more than 90 foundrymen, members and guests of the association. These monthly meetings will take place hereafter at the Fort Pitt instead of at the General Forbes hotel, as last year. Mr. Clark, who is superintendent of the alloys foundry of the General Electric Co., Erie, Pa., said that this new character will be known as the foundry physicist, and his office will be to uphold the principles of natural laws and forms. He illustrated his talk with interesting blackboard sketches.

Discussion was led by Dean C. B. Connelly of the Carnegie Institute of Technology and Lloyd Uhler of the Union Steel Casting Co. Dean Connelly also mentioned that before Jan. 1, 1926 the sand testing machines which will show the various qualities of sand including bond, grain, absorption and humidity will be in readiness for use at the institute. These machines have been perfected by the sand committee of the American Foundrymen's assoication.

Seek Rust Preventative

Question: We would like to know how to prevent the corrosion of cast iron by treating it with different chemicals and superheated steam.

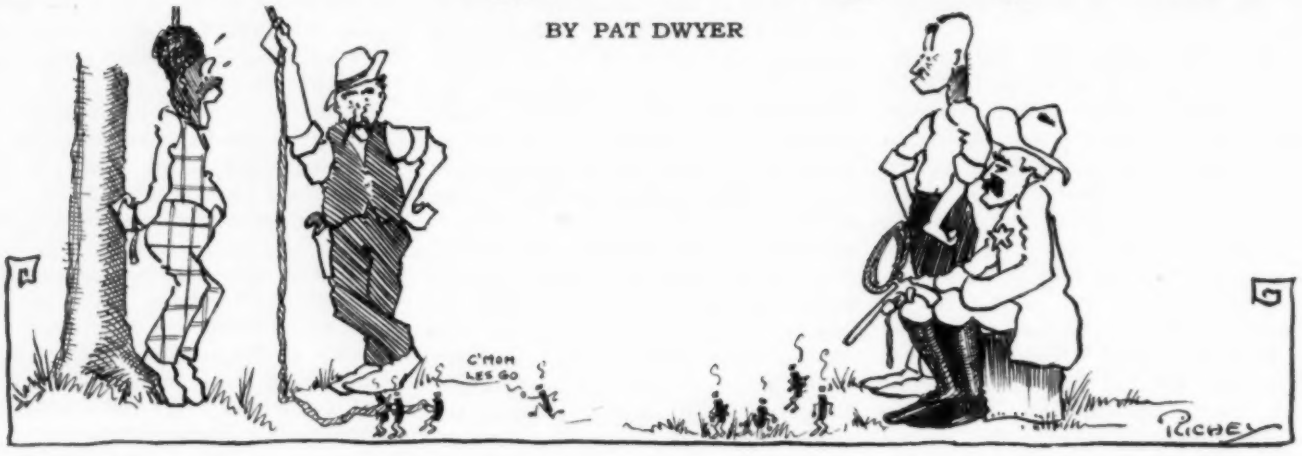
Answer: Bower-Barff is a name given to a method for forming a coating upon cast iron, wrought iron, and steel. This is attained by exposing the castings to a low red heat in special ovens, furnaces or retorts and subjecting them to the action of superheated steam and various gases alternately or in combination according to the different processes invented. An interesting article entitled, "Protecting Stove Tops from Rust" was published in THE FOUNDRY for Jan. 1, 1920. This article deals with an improved application of the Bower-Barff process in the treating of malleable iron castings to make them rust proof with description of furnace used.

An outline follows: The castings are in the first instance sandblasted and then preheated to about 1505 degrees Fahr., in a closed muffle. A partial vacuum being established in the muffle, and superheated steam 750 degrees Fahr. is admitted under about 4 pounds pressure. This partial vacuum condition is to remove a portion of the gases in the muffle and to permit the steam to act freely and equally on all parts of the castings. After approximately 4 hours treatment the castings are removed and dipped in a mixture of linseed oil and a balsam product called *fermaline*. The action of the oil changes the dull gray color of the castings to a black mat or coating highly resistant to ordinary oxidizing influences.

The design and operation of the ovens, furnaces or retorts have a great deal to do with the success of the processes involved.

Bill Throws Light on Lighting Problem

BY PAT DWYER



A RECENT article in THE FOUNDRY on lighting fixtures by H. R. Simonds reminded me of an extremely interesting exhibit displayed some time ago in the downtown office window of the company which supplies this city with the greater part of its electric current for light, heat and power. Twelve typical lamps were shown illustrating the gradual evolution of the lighting unit from the crude little earthenware saucer of the Phoenicians in which a feeble light was secured from a wick floating in an oil bath, down to the dazzling incandescent bulb of today which rivals old Sol himself in brilliancy.

A realization of a man's brief span of life on this earth was borne upon me as I gazed on some of these mute evidences of his handiwork. Countless thousands of men had appeared on the earth, had flourished for a short time, had played their little part on life's stage and had vanished as completely as the smoke that once spiraled upward from their lamps. Legend and tradition, vague and shadowy to a considerable extent is all we have to connect the past with the present and in the mind of the ordinary person the names of these men and the fame of their deeds is no more substantial than the impression remaining after the dreams that float through our subconscious minds at night.

The mind's eye in some respects resembles the physical eye. Just as an indefinite object is brought sharply to attention when viewed through a glass properly focused, so also the sight of an object actually connected with a certain period illuminates that period and brings it within the focus of the mental eye. Probably there is some explanation for this mysterious power by which a human being can project his mind back through the centuries, but up to the present I have seen no description. Certainly I am losing no sleep over my ignorance on this subject. It is only one more item added to the long list of things I do not know and probably never will know. I am satisfied with the knowledge that a man can throw his mind around to an almost limitless extent and that is enough to satisfy any reasonable human being.

I asked Bill the other night if he had seen the exhibition of lamps in the window and was not surprised to find that the effect produced on his mind was different from the impression I had received.

"Some of these lamps may have dated back to several centuries before the Christian era" said Bill "but even at that I bet they gave as much light as the evil-smelling, smoky, little tin lamps we had in the foundry when I was serving my time. Looking back now I often wonder why the significance of the term *serving my time* escaped me. The surroundings were dirty, dark and unsanitary. The work was hard, heavy and hot and no guard in a penitentiary ever wielded the autocratic power vested in the hands of the big gink who cracked the whip and made us jump through the hoops for 10 hours a day and as many additional hours as he saw fit. A few years ago I spent a few hours visiting a penitentiary and among other things I noticed that none of the jolly inmates were putting up a day's work comparable with that of their free and independent competitors on the outside. The lad who invented that term about serving time must have had his tongue in his cheek.

"Of course I must admit that conditions have changed greatly in the foundry in recent years. Light, ventilation and sanitary features in modern foundries compare favorably with those in any manufacturing plant. Mechanical installations relieve the workmen of a great deal of the old back breaking manual drudgery. Personal relations are conducted on a more satisfactory basis and the rate of remuneration is on a more generous scale. In view of these changes it is not surprising to find that the term *serving time* has fallen into disuse. A boy goes into a foundry now to *learn a trade.*"

"I had no intention of starting a discussion on foundry conditions," I said, "when I introduced the subject of lamps. I was thinking of the conditions under which these old dead and forgotten men made the lamps and used them. With the primitive facilities at their disposal I think they turned out some creditable pieces of work."

"Well" said Bill "I'll tell you. Those little pottery lamps may have been re-

CUSTOMERS AT A DEEP SEA FILLING STATION

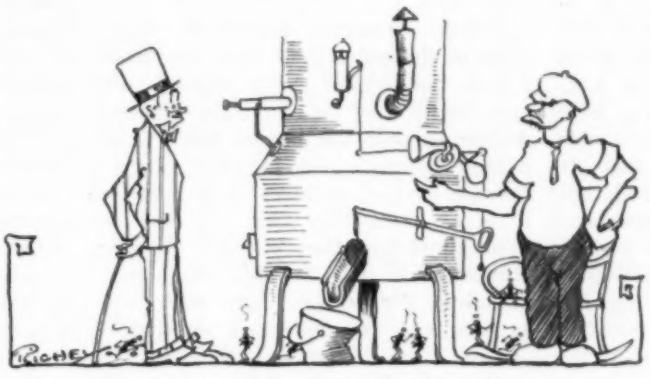
garded as wonderful in their day, but if the inhabitants derived any practical benefit from them they must have had sharper eyes than the people of the present day and age. If the truth were known I think you would find that they carried on all their activities by daylight. They were the original early-to-bed, early-to-rise lads. In fact the same condition obtains yet where lighting facilities are inadequate.

"However, I am willing to admit that some of the metal lamps produced in the early centuries present many points of interest. I imagine they produced more smoke than flame, but that was the fault of the fuel and the design of the burner and was no reflection on the skill of the craftsman who made the mold. Any time you want to start an argument on the subject you can drag in these old castings as convincing proof that the early foundrymen were ahead of their contemporaries in the application of the industrial arts. Architects and interior decorators hatched out what to then were marvellous designs in lighting fixtures and then calmly called for bids on a lot of 100 to be delivered without fail on the following Tuesday.

"Probably many foundrymen turned the job down after one look at the drawings, the terms of the contract and the price which the purchasing agent intimated he was willing to pay. However, some lad with the gambling instinct which seems to prevail to this day, always was found willing to take a chance. By working late and early he rushed the job through his shop and delivered the castings on time. He proved that the impossible could be done so far as craftsmanship was concerned, but you will find no evidence of income tax paid by these early foundrymen. Perhaps they considered the glory of achievement sufficient recompense.

"The old whale oil lamp of the early days of the eighteenth century, in my opinion was the most interesting of the entire collection. I cannot imagine any person going into ecstasies over the lamp itself either on account of the design, the workmanship or its utility as a lighting medium, but just think of the circumstances connected with the procuring of the fuel. There is a story that stands out as an enduring monument to the skill, daring, hardihood and courage of the race of men who go down to the sea in ships.

"For periods of from one to three years these ships pursued their lonely way, frequently circumnavigating the earth before the holds were filled with the evil smelling cargo and a course finally was laid for the old home port. I can understand easily how these men withstood danger and privation. Existence on a monotonous diet of plum duff, weevily biscuit and salt horse may be endured, but I must confess that the iron physique which enabled them to breathe the aroma which pervaded these floating garbage cans is beyond my comprehension.



BRINGING THE CUPOLA UP TO DATE

"Days of empty and aimless cruising with nothing in sight but the restless waste of ocean to the horizon's rim were interspersed with days of feverish activity and back breaking toil from the moment the electric cry of *There she blows* sent the boat crews racing madly over the water to the time when the last flake of blubber was swung inboard and deposited in the huge simmering kettles.

"Hard bitten, hairy old sea dogs with skins pickled in brine, toughened by exposure to every wind that blows over the seas, tanned by the equatorial sun, roared their deep sea chanteys and sailed the ships to the world's end and back again. Big and broad and bluff, with 10 feet of solid greenheart in their bows the vessels bumped the ice floes inside the Arctic circle where the bushing, feathery twin plumes of the bowhead promised a harvest. Sometimes they won out and succeeded in capturing their prey. At other times their boats were towed for miles in the wake of a monster with the strength and speed of a battleship and a fiendish desire to establish a subterranean record to the north pole. Faced with the alternative of being smashed on the ragged rim or drawn under the limitless field of ice the bow man had to cut the line and the crew, sour and sullen had to row the heavy boat over the weary miles back to the ship minus line, harpoon and whale.

"In storm and sunshine they pursued the cachelot in the Indian ocean, the south Atlantic and over the long rolling swells of the Pacific. Rambling like lost souls over the waste of ocean, cut off for months from human communication they occasionally saw a vessel blown far from the regular trade routes. Now and again while scudding under bare poles in a howling gale they were passed by a racing clipper homeward bound under the command of a ramping, stamping, dare-devil skipper who would see the sticks whipped out before he would take a rag off her. Reeling off her 18 to 20 knots, with the foaming green water cascading in sheets of spray from her knife-like bow and glittering copper forefoot, with her lofty masts bending under the strain of the billowy clouds of white canvas, one of these racers would lift her topmasts above the horizon, pass the lumbering old whaler like a sheeted ghost and disappear again beyond the far horizon in a few hours.

"These chance encounters might raise visions of home and kindred, of tree shaded streets, of little homes and gardens, of children playing on the village green, of rousing rollicking nights in the taverns of Salem and New Bedford; but the whaler's crew realized that many a long league of salt and stormy water intervened and many a long, weary and lonely day and night lay before them before the vision would be fulfilled.

"These men had their trials and tribulations, but they weathered them in one way or another until changing times and changing customs rendered the whaling industry obsolete. The ships long since have disappeared and the hardy crews are sleeping their last long sleep on the ocean bed or in some quiet haven under the hill. Steel has taken the place of whalebone and John D. Rockefeller and Edison knocked the props from under whale oil.

"Routine in the foundry does not call for the same qualifications that were essential in the officers and crew of a whaler, but business is business no matter by whom it is conducted and the success of a foundry depends fully as much in having a competent man in charge as the outcome of a whaling voyage depended on the instinct, knowledge and training of a knowing old skipper. You would imagine that any man would

be willing to admit the truth of such a self evident assertion and yet it would be funny if it was not so pathetic to find so many men who apparently think that a foundry may be managed by any person without the slightest knowledge of operating conditions.

"I was reminded of this by an incident the other day. A man who had taken over a small foundry came in to see me. He claimed that the volume of business would not permit him to hire a competent man to run the shop and since the foundry business was comparatively simple he felt that with a little coaching he could do all the necessary overseeing himself. I told him he was laying himself wide open for old man trouble to snatch him bald headed and fly away with his limited bank roll, but it was his funeral and not mine and I was willing to give him any technical points to the best of my ability.

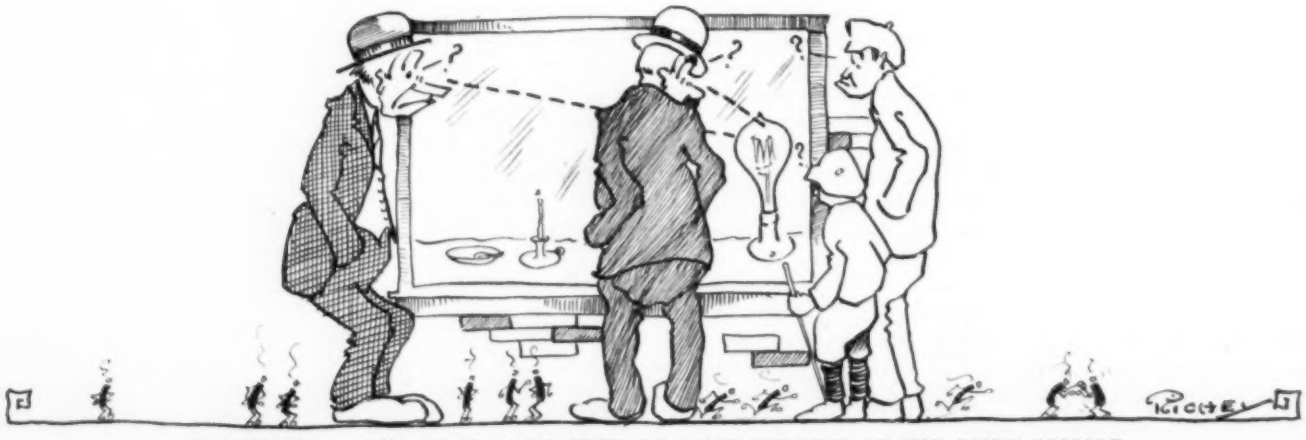
"He handed me the following list of questions touching on the operation of a 24-inch cupola: 1—Does the fact that iron runs over the spout 8 minutes after the blower is started, prove that the bed is the right height? 2—What variation may be noted in the time without proving the bed is too high or too low? 3—What is the maximum amount of coke that may be used with a 500-pound iron charge without changing the quality of the iron? 4—Does the air fulfill any other purpose besides melting the iron? 5—If the air is supplied in greater or lesser volume will that factor simply affect the speed of melting or will it affect the quality and temperature of the iron? 6—Is it necessary to poke the tuyeres? 7—What is the ideal blast pressure for a 24-inch cupola. To what extent may the pressure vary without affecting the iron adversely? 8—Is it practical to stop the blower and then start again during the progress of the heat? 9—Which course is preferable, to place the coke on the wood before lighting the fire, or to wait until the wood is well lighted before placing the coke? 10—Should the tuyeres and tap hole remain open or closed during the period the bed is burning and before the iron is charged?

"I pointed out to him that while the operation of a cupola is based on certain standard rules, still so many variables have a way of introducing themselves during the progress of a heat that a melter requires a broad general experience to meet them all successfully. However, taking the questions in the order they were presented I said that 1 and 2 are related and may be covered by a single answer. Assuming that the bed is fairly well burned through before the fan is started, if iron appears in 8 minutes it is an indication that the bed is approximately the correct height. However, if the furnace has been standing for some time with the tuyeres and tap hole open so that a strong draft is blowing through the charge, the iron may appear in much less time even with a high bed. On the contrary where the bed is not sufficiently burned through when the blower is started, iron may not appear for several minutes over 8, even with a comparatively low bed. 3—Using coke over the maximum amount required to melt the iron does not affect the quality of the iron. It simply retards the speed of melting and produces an extra amount of ash which helps to choke up the cupola. Where a minimum amount of coke is employed the iron in the charge drops down too close to the tuyeres before it is melted, with the result that it is burned or oxidized and cold coming through the tap hole. 4 and 5—The volume of air must be proportioned to the amount of coke that may be consumed in a given area in a given time. It is apparent that there must be an upper and lower limit. Between these limits the cupola will melt faster or slower depending on the amount of air delivered. The temperature of the iron is not materially affected by the volume of the blast within the limits mentioned. 6 and 7—The ideal blast pressure for a small cupola is 6 ounces but a variation of 2 ounces either way is not particularly detrimental. Other factors exert a bearing on this point. 8—Stopping the blower and then resuming during the progress of the heat will not materially affect the temperature of the iron if melting conditions are normal. The iron should all be drained out of the well after the blower is stopped. 9—The almost universal practice is to place the greater part of the bed coke in the cupola before the fire is lighted. 10—The question whether the tuyeres and tap hole should be left open or closed while the bed is burning, largely is determined by the amount of time available. Under certain conditions it may be advisable to provide a slow fire, but where the time is limited it is customary to leave the tuyeres open so that the fire may burn up quickly. Iron may be melted satisfactorily under either condition, provided all the remaining factors involved in the process are favorable."

"I have not heard from him since," said Bill. "Therefore I cannot tell you whether he made a shining success of the business, or just sank quietly with all hands. Advice is all right in itself but it won't work miracles and occasionally it is only so much perfume wasted on the desert air.

"'George' said the Texas sheriff to the colored gentleman sentenced to be hanged on the morrow, 'George' says he 'Have you anything to say before I pop you off?'

"'Yas indeed Mistuh she'uf' chattered George 'Ah has sompin to say. Dis heah li'l event suttinly will be a lesson to me!'"



CONTRARY TO YOUR FIRST GUESS THEY ARE NOT MEMBERS OF THE LIGHT BRIGADE

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

Note—This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in note book form.

PREPARING MICROPHOTOGRAPHS OF METALS

(*Continued From Data Sheet No. 592*)

Use of Grain Size in Specifications

9. If grain size is to be included in specifications, it should be expressed as the maximum or minimum allowable as determined above. It is recommended that only in extreme cases should grain size be made the sole basis of rejection of material.

Recommended Practice for Photography

10. The subject of photography as applied in metallography can be conveniently divided into the following sections:

I. Magnifications;
II. Lenses;
III. Illumination of Specimens;
IV. Photographic Materials;
V. Metal Radiography.

IV. MAGNIFICATIONS

11. In addition to the magnifications specified in Section 1, a magnification of 5 for use in the preparation of macrographs is recommended.

V. LENSES

12. In Table II have been grouped the various lenses and combination of lenses, which will be found convenient for obtaining different magnifications.

TABLE II

LENSES FOR VARIOUS MAGNIFICATIONS

	Objective		Ocular	
Linear Magnification	Type	Focal length (approximate), mm.	Type[1]	Remarks
10 or below...	Photographic.....	72	none	
10 to 20.....	Photographic.....	48	none	
20 to 30.....	Photographic.....	35	none	
30 to 75.....	Achromatic.....	32	Huyghens or similar	
75 to 150.....	Achromatic.....	16	Huyghens or similar	
200.....	Achromatic or apochromatic	8	.....	Compensated and "Projection" for apochromatic objectives.
200 to 500....	Apochromatic preferred.....	8	.....	Compensated for large fields.
		4	.....	Compensated for maximum resolution of fine structure.
1000.....	Apochromatic.....	4	.....	Compensated for large fields.
		2	.....	Compensated for maximum resolution of fine structures.

[1]The magnifying power of the ocular should be such that the desired size of projected image can be obtained with a moderate length of bellows.

(*Continued On Data Sheet No. 594*)

PREPARING MICROPHOTOGRAPHS OF METALS

(*Continued From Data Sheet No. 593*)

VI. ILLUMINATION OF SPECIMENS

13. For use with objectives of 32-mm. focal length or less, all of which are used in combination with oculars, vertical illumination (*i. e.*, normal to the surface under observation) is usually necessary. Either the plane-glass or mirror type of illuminator (the latter including the totally reflecting prism) in which the reflector is placed behind the objective may be used. For best results, the condition of "critical illumination," that is the optical distance from the source of light (real or apparent) to the surface of the specimen equals the distance from the specimen to the focal plane of the ocular, or, in other words, the source of light should be approximately imaged on the sample. The mirror type of illuminator is not suitable for very short focus objectives (4mm. or less), since it obscures a relatively large portion of the lens surface.

14. With objectives of the photographic type, vertical illumination is obtained by inserting the illuminator (plain glass) between the lens and the surface of the specimen. Oblique illumination may be obtained by directing the beam of light so that it strikes the surface of the specimen obliquely or, in a lesser degree, by rotating the reflector of the vertical illuminator.

15. For lenses of the photographic type of more than 48-mm. focal length, the illumination is either diffused: for example, daylight; oblique, as obtained by a beam of light directed upon the specimen obliquely from one side; or "vertical." For the last, a large "vertical illuminator" (plane glass) between the lens and object is used. In order to increase the size of the field, which otherwise would be restricted in diameter to that of the photographic lens, a relatively large plano-convex lens should be placed between the reflecting plane-glass and the source of parallel light, the lens being located so that the *optical* distance between it and the photographic lens equals the focal length of the plano-convex lens. Moistening the surface of the specimen with water, glycerin or oil will sometimes be found to be desirable for the purpose of increasing the contrast in the photograph.

16. *Illumination o Fractured Specimens.*—A good reproduction of a fractured specimen may be readily obtained by using two sources of artificial light of unequal intensities, placed one on each side of the specimen. A reflector may be used to replace the weaker light source if desired. The second, or weaker illuminant serves to neutralize

(*Continued On Data Sheet No. 595*)

Around the World with The Foundry

Little Journeys to the homes of our readers

France

EVER since Caesar's mail clad legions poured down over the Alps and set up their victorious eagles in the land of Gaul her people have maintained a position in the vangaurd of civilization, in advanced thought and in the arts and sciences. Romance and chivalry gleam and glimmer like golden threads through the warp and woof of their eventful and picturesque history. They rallied to the standard of the Maid of Orleans; followed the white plume of Navarre and marched in triumph under Napoleon's eagles from Marengo to the ill fated field of Waterloo. Explorers, missionaries and great war captains planted her banners and laid the foundation of a mighty empire in the new world which but for the turn of fortune's wheel might well be today under the aegis of the fleur-de-lis.

Ever a martial nation her extensive coast line has been the means of developing a powerful navy and an immense fishing fleet. Iron and steel works, porcelain and glass factories, beet sugar plantations and vineyards and the greatest silk factories in the world require an immense tonnage of castings and they are all produced within her borders.

French metallurgists and foundrymen rank with the highest, so when you read that THE FOUNDRY is read twice a month by the chief executives of 130 foundries including the world famous Schneider & Cie, La Creusot, you will realize the truth of the claim that

"Wherever metals are cast you'll find THE FOUNDRY"

Pie for the Trouble Shooter

Practical Knowledge Solved a Problem That Had Defied the Best Efforts of Theoretically Trained Men

By James A. Murphy

UPS and downs, mostly downs of foundry life were well illustrated recently in a case that came under my observation in a shop that had been bitten, or perhaps I should say stung by the rampant little industrial insect *troublosis major* or efficiency bug. Following a change in management, the contagion spread through the plant with a high rate of mortality that carried off all the heads of departments and many of the other employes.

Quick changes on occasions of this kind usually may be accepted as evidence that the managerial eye teeth have not yet been cut properly. The only regrettable feature of the process is that during the period of incubation and even after the infant has begun to toddle around a little unsteadily on its own legs, the expense of carrying on and the loss in revenue frequently leads to bankruptcy.

Changes in the personnel of an organization, in the mechanical equipment and in production methods are necessary and desirable under certain conditions, but to insure satisfactory results, any proposed change should be given serious consideration before it is placed in effect. Changes may bring men of vision to the front, but instead, they occasionally place visionaries on pedestals. Unfortunately, members of this latter class invariably are enthusiastic and ignorant, probably the best wrecking combination in existence. They are in a hurry. They have no time to waste trying to convert an old organization to their views. It is much simpler to clean the place out, dump the old crew overboard and start with a new organization.

I had been familiar with a certain foundry and with many members of the organization for years. The company enjoyed an enviable reputation for its castings and its service, features made more startling by contrast with changed conditions prevailing on the occasion of my recent visit.

Resenting changes in foremen, labor conditions and other features of the new dispensation, the old gang of molders had disappeared and found employment elsewhere under conditions more to their liking. The new efficiency organization worked diligently. In fact it might be said they worked too diligently. Usually they made each casting over several times.

Confusion Department

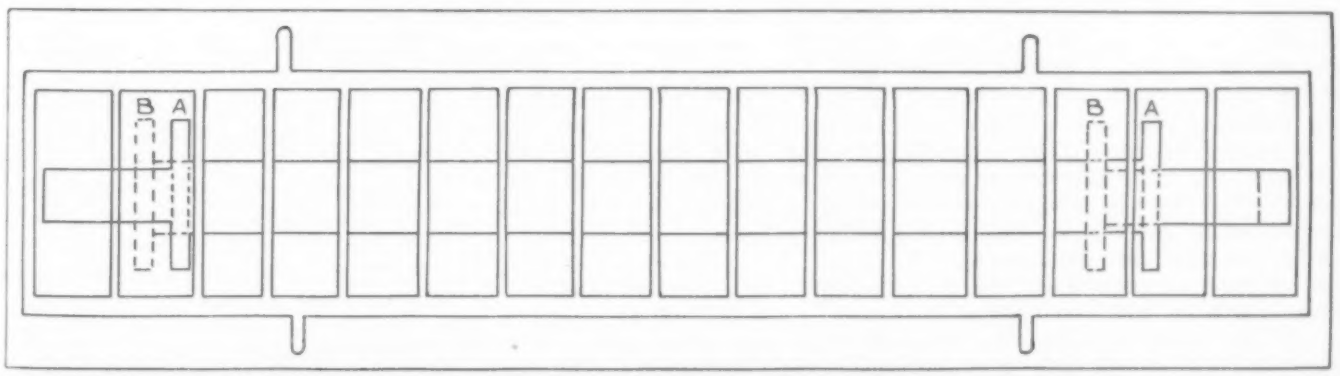
A production department had been established in imitation of some large plants where these luxuries can be afforded. Whatever excuse for existence such a department had elsewhere it was an amusing if somewhat pitiable farce in the present instance. It should have been called the confusion department. The daily functioning of this one precious department caused more confusion and commotion than ever were witnessed at Gettysburg, Waterloo or at Linden when the sun was low and Iser was rolling rapid-lee. Troubles to the right of them, troubles to the left of them, troubles behind them and the Lord only knows what trouble the future holds in suspension.

A typical instance of the many practical problems for which no person could furnish a solution is shown in the accompanying illustration. The casting was a plain piece of steam pipe 10 inches diameter, 10 feet long with a regulation flange at each end. Several castings were made and lost in succession and no person could explain the mystery. Each time the casting was shaken out, one flange was found cracked completely from the body of the pipe and only held in place by the core.

Several more or less scientific theories were advanced to account for the phenomenon. The favorite was that the phosphorus content of the iron was too high. Any person who *is* any person, of course knows that high phosphorus is detrimental to strong iron. A second theory and one that also had its valiant supporters was that the core was too hard and prevented the pipe from contracting normally. Many other minor theories were presented such as the trouble was caused by wet sand, hard ramming or oxidation which filled the flange with bubbles and so weakened the iron at that point that it naturally cracked in cooling.

A chemical analysis of the iron yielded no clue even to the analysis sharp who analyzed the analysis. Gentlemen who make a specialty of taking photomicrographs were called in to expatiate in their learned style and from a point of high visibility, on the characteristics of pearlite, cementite, austentite and other tites, but none of them could make the casting tight. When I finally was consulted the problem was regarded as hopeless.

Many curious theories were based



IN THE FIRST INSTANCE THE FLANGES ON THE PIPE OCCUPIED THE POSITION CLOSE TO THE BARS IN THE COPE AS SHOWN AT *A*. WHEN THEY WERE CHANGED TO THE POSITION *B* NO FURTHER TROUBLE WAS EXPERIENCED FROM CRACKED FLANGES

on these cute little mikes extended, expanded and inflated from the diameter of a lead pencil to approximately the diameter of a ginger snap. In fact they bear such a striking resemblance to these sniffy little dainties that instances are on record where with the context missing their own authors have been unable to distinguish between them.

Fortunately, no one had made a survey of the possible effects of molecules, microbes, miseries or miracles on the fracture. I was not hindered or handicapped in any manner from making my own plain and simple diagnosis. The instant the cope was set in place over the pattern, the cause of the cracked flange was apparent. I needed no further evidence. Originally the pattern had been a little too long to fit inside the flask, and to remedy this condition a short section had been cut from the end of each of the long core prints.

Under the old regime the molder would have placed the pattern on the empty cope in such a manner that the flanges would have ample clearance between the bars. Then he would have cut the prints in such a manner that the pattern would occupy a corresponding position in the drag. Under the new efficiency system the molder was not consulted. He was given the flask with the pattern cut to fit the drag. He was not supposed to talk or ask any questions. Distractions of that kind impair the efficiency curve. He rammed the drag full of sand, rolled it over, but when he set the cope in place he found that two of the cope bars just cleared the flanges on the inside. They fitted so closely that the molder had to daub sand on the face of the bar after the pattern was removed. With this coating of sand and an additional coating of lead rubbed on by hand, the metal laid quietly in the mold and a casual examination of the casting revealed no unusual features.

Fortunately the prints on the pattern were ample to permit further curtailment at one end. The pattern then was placed properly in the flask and no further trouble was experienced with broken castings.

As a further evidence of misdirected efficiency two molders and two helpers put in a whole day on each of these pipes and produced a waster every day. I could not help contrasting this performance with what was common practice in the house work shops of New York and elsewhere at a time when I was familiar with that district. A molder single handed made two columns nearly twice the size of this pipe in a day and never had any wasters. Oh! Efficiency thou art indeed an industrial fake jewel, in many instances.

The Abrasive Co., Philadelphia, has taken possession of its enlarged office building which joins its main plant at Bridesburg, Philadelphia. The office space of the company has been doubled by this new addition.

Apprentices Lead Merry Life in China

THE American youth would be sadly handicapped if he had to serve his apprenticeship in China. The period is for three years and during this time he receives his food, lodging and the munificent sum of $1 *a month for bath and haircut money. Perhaps, by being economical, he may even buy some clothing with this generous sum. But this is not all, for at each Chinese New Year he is presented with a proverbial Croesus' horde of* $8.

After the three-year period the apprentice becomes a master workman and receives from $12 *to* $35 *a month, including his food and lodging. With this generous wage he probably buys a flivver and cuts up most unbelievably because his employer says that the labor problem is most difficult. According to complaints, the craftsman is prone to quit work until he spends his savings.*

Although China has entered the brassware field only within the last few years, over 400,000 *pounds of brass ware valued at* $500,000 *has been shipped abroad. The chief centers for this business are Canton and Shanghai. The articles are mostly small figures of Buddha, pagodas, incense burners, bowls, etc. The brass foundries make the brass and sell it by weight to the factories. It is remelted and poured into molds of various types. The final work of polishing, beating and engraving is done by hand. Each shop employs a superintendent and a few master workers, but nearly all of the work is done by the aforementioned apprentices.*

New Sand Supplies the Bond in Old Sand

Question: What element binds the grains of molding sand together and is it possible to add this element to old sand in any manner except the usual one of adding new sand. Has this subject ever been covered in THE FOUNDRY?

Answer: Answering the last part of your question first, it may be stated practically every phase of the sand question has been covered in THE FOUNDRY, not once but many times. The particular point you raise in your present inquiry was the subject of a paper prepared by Henry B. Hanly as the annual exchange paper of the American Foundrymen's association and presented before the international foundry congress held in Paris, Sept. 12-16, 1923. The paper was published in THE FOUNDRY, Sept. 15, 1923, on pages 745-6 and -7.

In non-technical language, clay is the bonding element in molding sand. The relative amount of clay and the manner in which it is distributed among the sand grains determines the permeability, strength and refractoriness of the sand. In ordinary molding sand the bond is derived through decomposition of the original granite. Granite is composed of quartz, feldspar and mica. In the course of decomposition the more easily soluble mica and feldspar are broken down and the feldspar breaks up into clay which deposits itself on the grains of sand.

A considerable amount of experimental work has been devoted to finding methods for rejuvenating molding sand. The net result to date indicates that the life of any sand is prolonged by thorough and intensive mixing each time it is placed in service. However, the bond in any sand eventually is destroyed and the commercially practical method discovered up to the present for renewing it is by adding new sand.

Melting Loss in Cupola

Question: Can you give us the approximate metal loss when melting iron in a cupola furnace.

Answer: The lighter the section of the metal, and the rustier it is the higher the loss when melting in a cupola. The average melting losses of the various metals in a cupola furnace are as follows:

	Per cent
Machine-cast pig iron	0.30
Sand-cast pig iron	1.00
Car wheels	2.00
First quality machinery scrap	2.50
Light machinery scrap	3.50
Stove-plate scrap	8.00

Square Is an Essential Tool
in Making Patterns

Diversified Uses Make Square Basic Tool for Those Engaged in Construction Work—Instrument Should Be Tested When Buying

By Walter C. Ewalt

THE square is common to all those who construct things in an architectural or mechanical manner. The patternmaker, bricklayer, carpenter, millwright, cabinet maker, machinist, molder, architect, draftsman and many others use it constantly. A few trades find little use for the square, as for example ship builders or wood carvers, but it may be considered as being used universally by those who build. Even the farmer plows his ground and plants his corn in straight rows, parallel and square with one another so that in standing in one spot, one may see in looking at the rows many uniform straight rows. This is mentioned merely to show that in observing the different occupations of man, we come in contact with many applications of the uses of square lines.

The 24-inch carpenter's steel square is a useful and necessary tool needed by a patternmaker. The principal use of this instrument is in laying out work, squaring boards to be cut and in squaring up various patterns. One arm of the square is called the body, although it also is known as the blade. This arm is 24 inches long while the other arm, which is called the tongue, is either 16 or 18 inches long. The body is 2 inches wide and the tongue is 1½ inches wide. At the junction of the blade and tongue, the metal is 5/32-inch thick and at the ends 1/16 to 3/32 inch—this variation in thickness gives the square a better balance than if the same thickness was maintained throughout.

As a general rule, the various types of the square manufactured by different firms are comparatively perfect. However, when purchasing one, it should be tested by applying to a board which has a straight edge, and then reversing the square, as shown in Fig. 1. This illustration purposely shows the square not true or as it is called in shop terms *out of square*. The square is laid on the board as shown by the dotted line and a line scribed with a knife. The square then is reversed and if the lines coincide, the square is true. The illustration shows an opening at the ends of the tongue, denoting that it is *out of square*. The square may also be out if the opening shows near the junction of the blade and tongue.

The face and back of the square with lines and figures are shown in Figs. 2 and 3. The scales are made of divisions and subdivisions of feet and inches. The side shown in Fig. 2 is called the face, because this side is used most. The outside edge of the square on the blade and tongue

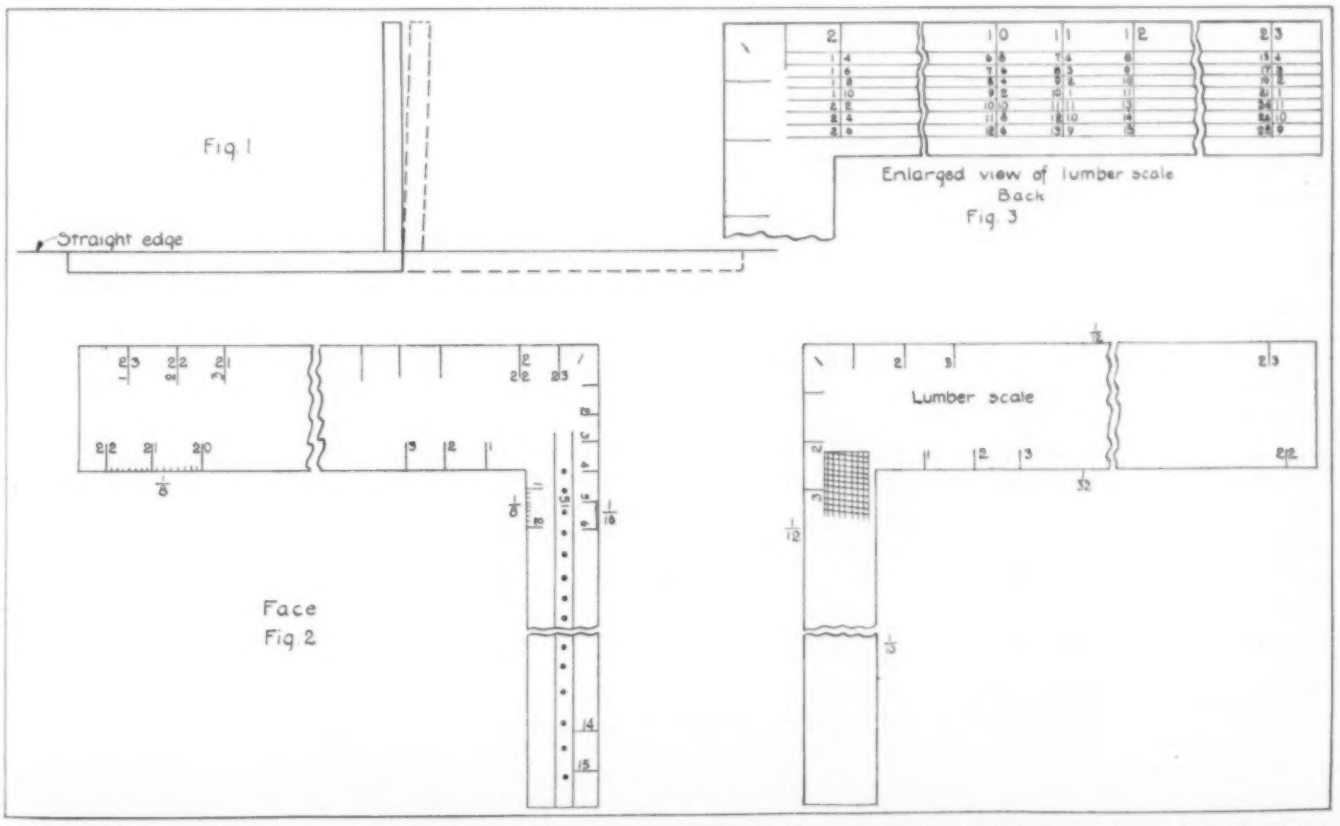


FIG. 1—TESTING THE SQUARE WITH A STRAIGHT EDGE. FIG. 2—THE TWO FACES OF THE INSTRUMENT. FIG. 3—LUMBER SCALE SHOWN ON THE TOOL

is divided into sixteenths of an inch, while the inner edge is divided into eighths, the numbers increasing from the apex of the angle toward the ends of the arms. In the center of the blade, the numbers increase from the end of the blade toward the apex. Small dots are located on the center of the tongue, every fifth one being numbered. These dots are used to obtain lines for octagons when a square timber is to be made eight sided. For example, if the timber shown in Fig. 4 which is 5 inches square, is to be made eight sided, lines are drawn through the centers of the sides and on each side of the center the distance equal to 5 of these dots on the square is measured.

On the blade at the back of the square, shown in Fig. 3, the divisions of the inch on the outer edge are in twelfths and the inner edge is divided into thirty-seconds while the lumber or board measure is in the center of the blade. Board measure always is figured as one inch thick, that is, a board one inch thick, 12 inches wide and 12 feet long contains 12 square feet, while if it is 2 inches thick, the board contains 24 inches feet. The board measure is calculated by calling the outside edge row of numbers from 1 to 24, the different widths of board. Under the numbers 8, 9, 10, 11, 13, 14 and 15 are shown and these represent the lengths of boards, as well as the number of square feet. As was stated previously, the outer edge row represents the widths and 12 is one of the figures. Therefore, a board 1-inch thick and 12 inches wide and 8 feet long, (the first number under 12), contains 8 square feet and so on down the list of numbers, 9 feet long contains 9 square feet, 10 feet long contains 10 square feet, etc. The figure 12 is left out since it is obvious that a board 1 x 12 x 12 contains 12 square feet. To test this scale suppose the number of feet in a board 1 inch x 10 inches x 13 feet is desired. Look under 12 and find 13, then follow that line back to the corresponding number under 10 which is 10 feet 10 inches. This represents the number of square feet in the board.

To prove this in a short easy manner—

$$\frac{1 \times 10 \times 13}{12} = 10\ 5/6 \text{ or } 10 \text{ feet } 10 \text{ inches}$$

If we reduce 13 feet to inches we have

$$\frac{1 \times 10 \times 156}{144} = 10\ 5/6 \text{ or } 10 \text{ feet } 10 \text{ inches}$$

These two problems of figuring lumber will become handy since in many pattern shops, the pattern maker requisitions the lumber necessary to build his pattern and in figuring up the job, he must know the number of feet wanted.

On the outside edge of the back of the tongue, the divisions are 1/12 inch, while on the inner edge, the divisions are 1/10 inch. The brace measure is given between these two sets of figures. These figures merely represent the base, altitude and hypotenuse of an isosceles right angle triangle, that is, one having two of its sides equal. If we take the figures toward the outer end of the arm, having the sides 24 inches and the hypo-

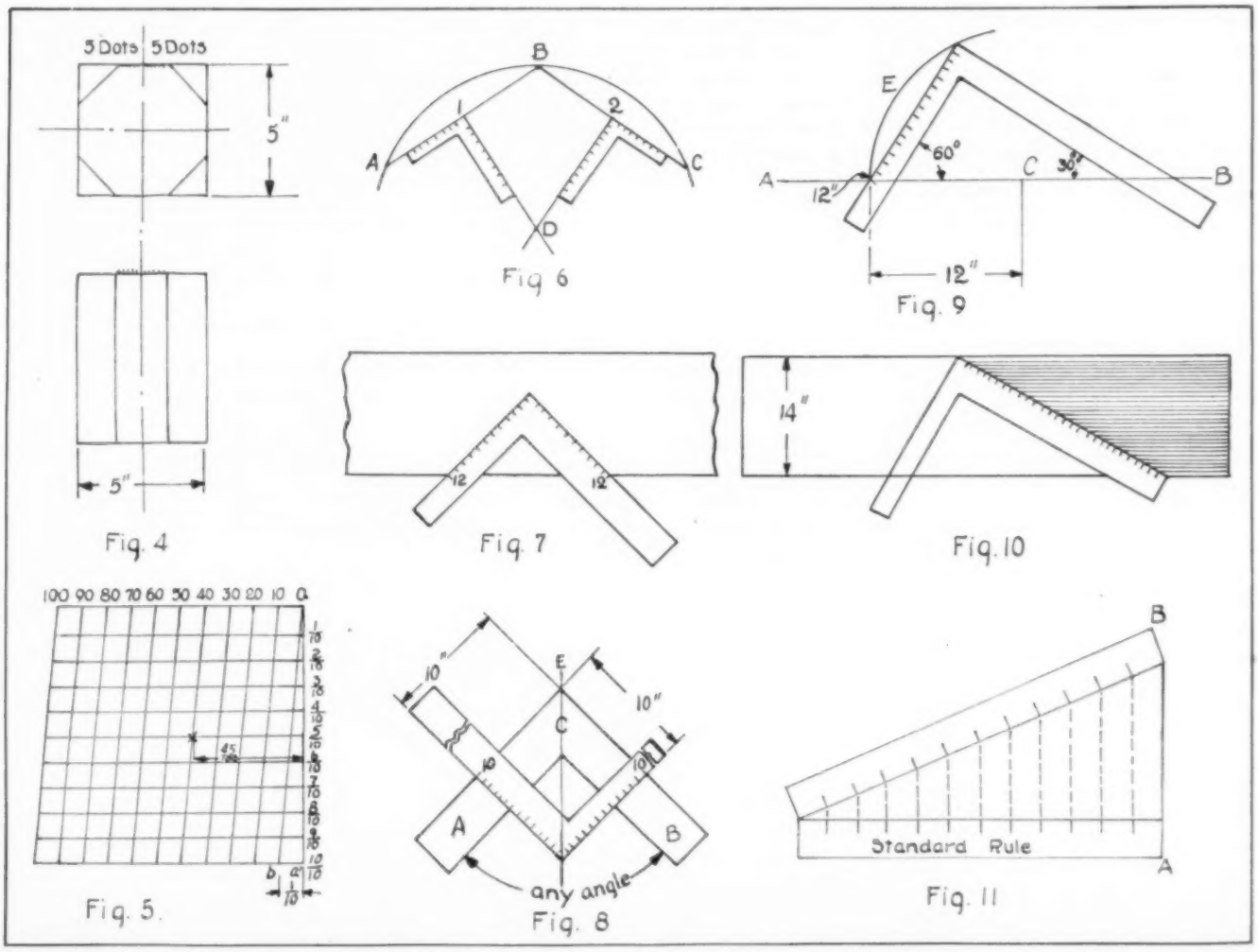


FIG. 4—SQUARE MAY BE USED IN MAKING OCTAGONS. FIG. 5—THE HUNDREDTHS SCALE IS GIVEN. FIG.6—FINDING THE CENTER OF A CIRCLE. FIG. 7—A MITER CUT. FIG. 8—A BEVEL CUT. FIG. 9—FINDING ANGLES 30 AND 60 DEGREES. FIG. 10-11—DIVIDING A BOARD INTO AN EQUAL NUMBER OF SPACES

tenuse 33.95 inches, this may be shown by the following.

24 × 24 equals 576
24 × 24 equals 576

1152
576 + 576 = 1152
√1152 = 33.94 plus

The brace table is used chiefly by carpenters in constructing roofs as it gives the lengths of rafters and distance across the spaces. A roof of this kind is called a half pitch.

Near the junction of the two arms, on the back of the square is a series of horizontal lines two inches long as shown enlarged in Fig. 5. Through 1 inch of these lines, other lines cross the horizontal lines at an angle. This is the 1/100 scale for from it hundredths may be obtained. The horizontal lines are 1/10 inch apart. The slanting lines also are 1/10 inch apart, but the first line starts on line AA^1 at point A and when it reaches B—the distance between A^1 and B is 1/10 of an inch. The use of this scale may be noted in the following example. Suppose the distance 45/100 inch is wanted. Count over 4 spaces from A as this represents 40/100 and then count down on the diagonal line 5 spaces to where the cross is marked. Then the distance from the cross to line AA^1 on that horizontal line equals 45/100. Scientists tell us that the earth contains 80 odd elements and they are beginning to think that these originated from one other element. These 80 odd elements with their combinations make a countless variety of things which surround us and which make us think in writing of the square and the number of uses and problems which can be worked out with this one tool.

A number of problems will be given, which will be of advantage to the patternmaker when using the square.

To find the center of a circle when three points are given. In Fig. 6, A, B and C are the three points. Connect these three points with straight lines. Divide the lines by two and square down from 1 and 2 and the point where the lines intersect, as at D, is the center of the circle.

A miter cut is obtained by using an equal distance in inches on the square as shown in Fig. 7, in this case 12 inches on each arm being used. The bevel cut for any angle is shown in Fig. 8. Pieces A and B are to be cut and joined at C. By laying out lines at the given angle and placing the square on the lines as shown, in this case 10 inches on each arm of the square and on points say 10 inches from E, then drawing a line from the apex of the square to E, gives the desired bevel.

To find the angles 30 and 60 degrees, bisect line A B at C in Fig. 9. Assume the distance A C to be 12 inches. With the compass draw a radius of 12 inches, with C as a center, as shown at line E. Then 12 inches on the square is placed at A, the apex of the square against the radius line. Lines drawn at the edges of the square will give 60 and 30 degrees.

A convenient method of dividing a board into an equal number of spaces is shown at Fig. 10. Suppose a board 14 inches wide is to be divided into 24 equal parts. Lay the square across the board as shown, the apex at one edge of the board and the 24 inches end at the other edge. Then mark off the inches on the board and the result will be 24 equal spaces. This method is applicable if a shrink rule is desired, which may be out of the ordinary. Suppose a 1/12 shrink rule is desired. Lay down a scale 12 inches long and at one end draw a line square with the scale as line A B. Take a piece of wood about the size of a scale and 12½ inches long. Let one end of the wood scale rest at the end of the 12-inch scale and the other end of the wood scale rest on the perpendicular line. If lines are drawn square from each division of the 12-inch scale and are transferred to the wood scale, the divisions will be increased in length, but will equally divide the 12½ scale. This is shown in Fig. 11.

Faked Foundry Facts

The Charge

Discusses Apprenticeship Training Courses

Apprenticeship training was discussed by Harold S. Falk, works manager, the Falk Corp., Milwaukee, at the first regular meeting of the Quad-City Foundrymen's association which was held at the Davenport chamber of commerce, Davenport, Ia., Sept. 21, with 70 members present.

Mr. Falk largely is responsible for the success of the apprenticeship training work carried on at the Falk corp., where the number of apprentices has increased from 12 to 160 during the last five years. He emphasized the need of furnishing the boy with a definite goal to aim at and to keep him interested, and stated that in the apprentice course at the Falk Corp. the interest of the parents was solicited, thus assuring the boy of greater encouragement and moral assistance to complete the course successfully. He told of the old method of apprenticeship training where the boy was indentured for three or four years to a firm who would train him in its methods. After completing the course, the boy no doubt was a good mechanic in a plant doing the same line of work as the one in which he received his training, but probably was lost more or less when confronted with a different class of work. In Milwaukee an industrial group has apprentices move from one shop to another, thus being drilled in many angles of the trade. The result is a good all around mechanic and a potential foreman.

The discussion which followed the talk brought out points which will be of value in working out an apprenticeship training system for the local foundries.

To Produce More Castings

The Russian Soviet government states that production of cast iron during the coming fiscal year will be increased to 2,723,400 metric tons under the plan adopted by the executives of the metal industry. This is 59 per cent of the prewar output, 89 per cent of the prewar output in plants now working, and 192 per cent of the output for the current fiscal year.

They Said That It Couldn't Be Done

And He Did It

WHEN Dan Ryan at the tender age of 14 timidly entered a foundry in Brockville, Ont., and started to take his first lessons in the ancient and honorable art of founding in metals he had little conception that eventually he would become one of the best known foundrymen in America through original investigation along many lines, or that before he was 50 he would be president and active head of a company with foundries in Cleveland, Ecorse and Lansing, Mich.

At the age of 17 when the average young man of today languidly is contemplating the prospect of finishing his last year in high school, Dan was a journeyman molder able and willing to handle any job in the shop and with a reputation for speed equal to any of the high liners. Fired with a laudable desire to see more of the world, to broaden his knowledge of the trade and to measure his skill with artisans elsewhere he gathered up his tools and spread his wings for a flight into unknown territory. For a period of 13 years he roved far and wide and acquired a comprehensive knowledge of the foundry business that stood him in good stead when he finally became foreman of a foundry in Cleveland and later built and operated foundries of his own.

Foundrymen in those early days were no kindergarten infants. A man had to use his fists for offense and defense in addition to the legitimate duties for which he drew remuneration. Dan was ready and willing at all times to accommodate any young gentleman with a grievance real or fancied, but he had his limitations. Just before leaving the old home town he had an animated dispute over a nice technical point with a large, hairy, heavy set gentleman. The arguments of the party of the second part prevailed on this occasion, but a few years later when our hero had developed a physique on the same general lines as one Mr. Jeffries, he had the pleasure of resuming the argument and this time the party of the second part practically was annihilated. Dan is a conscientious lad who believes in paying all his debts—with interest if necessary.

Six feet in height, broad and strong with a natural liking for hard work and an instinctive capacity for applying short cut methods and developing rigging for making half a dozen castings grow where one grew before he invariably earned wages greatly in excess of the prevailing rates. A typical instance was a small job in a Cleveland foundry nearly 30 years ago that paid 11 cents each and on which men continually were quitting because they could not make a day's wages. When Dan got the job he devoted two days of his own time to making a double match and thereafter ran the entire order of 7000 out at the rate of 65 a day and with a total loss of 27.

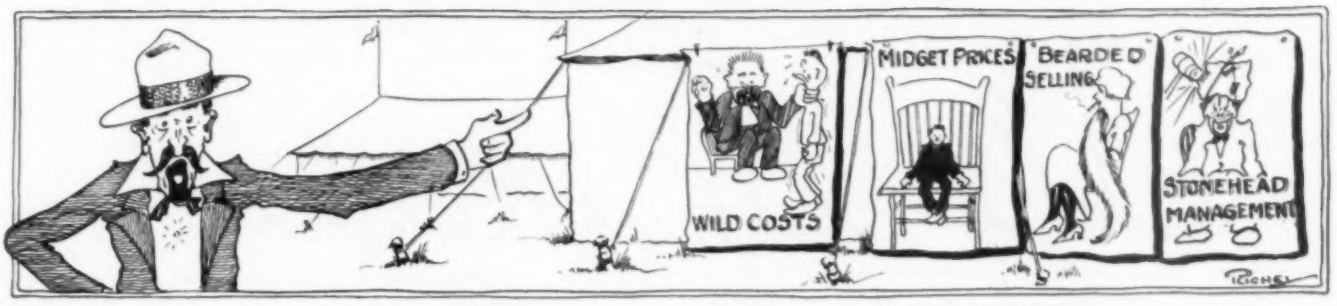
If medals and awards of merit were handed out as freely in industrial life as they are in the field of sport or in the army Dan would not have room on his ample chest for all to which he is entitled. One with a special ribbon is due him as the maker of the first automobile cylinder block cast in America. He had charge of the Interstate foundry in Cleveland when the founder of the Winton Motor Car Co. imported a cylinder from France to serve as a model. Dan's reputation as an ingenious and resourceful foundryman induced the manufacturer to place the job in his hands.

He took the model casting into the yard and carefully knocked it apart with a sledge hammer to get an intimate inside view of the construction. Then he designed and had built a pattern and set of coreboxes to meet his personal requirements, and afterward made the mold with his own hands. His confidence in his skill and ability is indicated by the fact that although the original casting had been made in a dry sand mold, he made the mold in green sand. He has made hundreds of thousands of castings in green sand since that time, notwithstanding the fact that many foundrymen who entered the field later claimed that it could not be done and considered the dry sand mold an essential feature of the process. Gradually nearly all American foundrymen have been converted to his views, but in a few instances even yet dry sand molding is practiced on cylinder blocks.

In addition to developing ingenious rigging to simplify molding process so that mass production of these intricate castings might be secured from comparatively unskilled operators, he developed and standardized an iron mixture particularly suitable to their exacting requirements.

In 1913 he organized the Allyne-Ryan Foundry Co., and built a foundry to specialize exclusively in automobile castings. Many wise men at that time said it could not be done—but he did it. The original capacity of the shop was 25 tons a day but justification of his business sagacity is apparent in the fact that the plant was expanded in a few years to a capacity of 150 tons a day. A second plant was placed in commission in

(*Concluded on Page* 849)



Persistence Pays Profits Even in RE-TELLING FORD JOKES

P. T. Barnum Says!

SIR, advertising is like learning—a little is a dangerous thing. A French writer says, "The reader of a newspaper does not see the first insertion of an ordinary advertisement; the second insertion he sees, but does not read; the third insertion he reads; the fourth insertion, he looks at the price; the fifth insertion, he speaks of it to his wife; the sixth insertion, he is ready to purchase, and the seventh insertion, he purchases.

TOO MANY people nowadays look upon advertising, or in fact any sort of sales promotion work as business magic. They spend a nickel and expect it to come rolling back all cluttered up with other nickels, a few odd dimes and a dollar or two. Most of the time, in this world, we get just about what we pay for. The man who advertises his product once, whether it be chewing gum or castings has no more reason to expect results than the fellow who watered his gladiolas with a medicine dropper.

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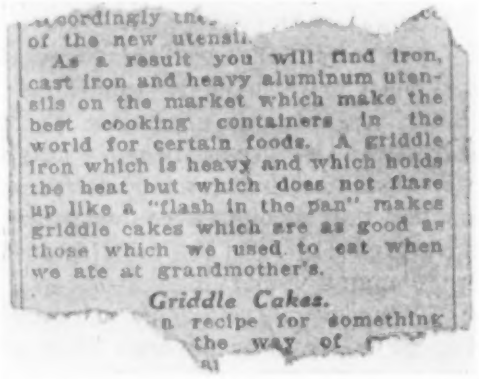
GOOD advertising, like any other form of successful selling, is made up of *persistent* application of intelligent effort. I noted in a signed article on the household page of our favorite fireside paper the other night, a remark that struck me as an evidence of how this is true. This is the passage that stuck out like a sore


accordingly the
of the new utensil.

As a result you will find iron, cast iron and heavy aluminum utensils on the market which make the best cooking containers in the world for certain foods. A griddle iron which is heavy and which holds the heat but which does not flare up like a "flash in the pan" makes griddle cakes which are as good as those which we used to eat when we ate at grandmother's.

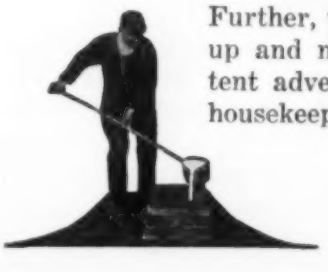
Griddle Cakes.

a recipe for something
the way of

thumb and stirred my memory for I knew that I had seen the same idea expressed in some foundry advertising. Today, I encountered an advertisement in a large city daily which hooked up with the remarks of the cookery artist previously reported. The Griswold Mfg. Co., Erie, Pa., or some marketing agency of that interesting organization, ran a two column advertisement in a large city paper, with a cut depicting a cast-iron pot with the lid raised to disclose a succulent roast. The caption was NOTHING ELSE COOKS MEAT SO TENDER AS A CAST IRON POT. Although I have no positive evidence to support the statement, I am willing to give suitable odds that the lady who wrote the recommendation for the heavy cooking utensils had read this advertisement and many others like it.

—: :—

IRON foundries have not been alone in defending the field of cast cooking utensils against invasion from without. Doubtless if you ask your wife she will tell you either through personal observation or hearsay of a sales demonstration which is being used to market cast aluminum cooking vessels. Intelligent young salesmen ask some housewife for permission to use her kitchen and then invite a number of neighboring ladies to a free dinner, which is prepared and served by the salesman. The hostess receives a gift of some aluminum utensils and others are given as prizes to the guests, who give their names and addresses to the salesman. Good stunt, isn't it? Further, this sales effort is backed up and made effective by consistent advertising in the home and housekeeping magazines.



Phineas, Jr

The Shakeout

DAN M. AVEY, Managing Editor
PAT DWYER, Engineering Editor
CHARLES VICKERS, Nonferrous Editor
FRANK G. STEINEBACH, Associate Editor

¶ Standing Still or Slipping

AN OLD proverb states *One can stand still in a flowing stream, but not in a world of men.* You must either forge ahead or drop behind in the race.

There was a time when men were sought out to assume responsible positions in the world, but in this age of advertising and self assertion, he who hides his light under a bushel is unknown to the public. As George Ade said, he "meets few prominent people." No matter how able he may be, the fact is known to but a few. Hence every individual should bring his ideas and knowledge before others who share his chosen field.

THIS may be accomplished by various methods. One is to become a member of a society of national scope that relates to the chosen profession or trade, and the other is to make oneself known through the technical magazines that serve that particular field. To be merely a member of a society is not enough. One must be an ACTIVE member, one who works, who serves on committees, presents papers, and attends the conventions. Contributing articles is helpful and he is poor indeed whose experience does not yield some information of value to others. Don't be too modest. The meek and the lonely may inherit the earth but not immediately.

¶ Demand Marks the Path

DID the development of the automobile bring about a new era industrial development, or did the expansion of manufacturing facilities make possible the modern motor car? This means like a variation of the age old theme of the hen and the egg, and perhaps it is as impossible to answer. This much at any rate is admitted. The strenuous demands of automotive service have brought many changes in the foundry industry.

High speed production made necessary the change from dry sand to green sand in molding automobile cylinders. Service requirements brought changes in gray iron metallurgy to produce a tight cylinder, free from defects. Later the need for greater quantities brought changes in the methods of making these particular castings and the lessons learned have been passed along to other branches of the foundry industry.

RECENTLY the trend toward permanent mold castings has been hastened by automotive requirements. Pistons, small accessories, and even cylinder heads of gray iron have been made successfully in long life molds, while many small parts in white metal have become practically standardized under permanent mold production.

The more recent developments induced by automobile manufacture have been along the lines of special alloy development. Progress has been made in nonferrous alloys for special services. Attention is directed now to ferrous metals and the future promises much in the way of high strength, corrosion and wear resisting alloys.

¶ Dad's Job Looks Good

REMEMBER how big and strong and altogether grand your dad appeared to you when you were a boy? Whether he drew on his clean overalls and jumper, picked up his tin lunch box with the cup atop and strode away to take the throttle of preferred fast freight No. 43, or simply donned his carefully dusted second best coat to leave for the office, you felt that some day you would do just as he did. You wanted to be just like him, when *you* became a man.

HOW great an influence this emulation of one's dad has upon modern industrial life is shown by a recent study conducted by the National Industrial Conference board. This investigation demonstrates that few decide to cast their lot in a given line through actual working experience in that industry. In the metal industry it is stated that many young men seek employment because of some family influence, or some family ownership or interest, or perhaps because of the environment, that is through living in the neighborhood of an industrial establishment. The age old habit of the son following in his father's footsteps still is a vital factor in influencing the young man's choice of a job.

Trade Outlook in the Foundry Industry

AUTUMN business is holding up to early expectation. While no marked increase in castings sales is noted, the volume of orders is satisfactory in practically all lines. The last three months of this year are expected to show a total business and a rate of foundry operation ahead of the corresponding period last year. Retail trade in practically all lines has been satisfactory. Automobile business has displayed unexpected fall strength. Building construction continues at a good rate, and is expected to hold steadily through until the first of the year. Farm prospects are excellent.

Rail Buying Holds Off

One large factor in foundry operations has not fulfilled early expectations. The railroads are not buying cars in the quantities that had been expected although inquiries extant run well over 14,000 freight cars. Further, orders for track material are appearing and freight shipments continue at a high rate. During the seven day period, ending Sept. 19, freight loadings totaled 1,098,428 cars, which represents a gain of 123,000 cars over the preceding week. The surplus car figures have been dropping steadily since August. With these factors under consideration, coupled with the highly satisfactory earnings of the railroads during the year, early buying of cars is expected. The dearth of freight car orders has had a marked effect upon the demand for certain classes of castings. Malleable foundries and those making railway steel specialties have been particularly affected. Repair business, while increasing has failed to maintain foundry operations in these two important branches of the industry.

Prices for Raw Material for Foundry Use

CORRECTED TO OCT. 2

Iron		Scrap	
No. 2 foundry, Valley	$19.00 to 19.50	Heavy melting steel, Valley	$17.75 to 18.00
No. 2 Southern, Birmingham	19.00 to 19.50	Heavy melting steel, Pitts.	18.50 to 19.00
No. 2 foundry, Chicago	21.50	Heavy melting steel, Chicago	16.00 to 16.50
No. 2 foundry, Philadelphia	21.26 to 21.76	Stove plate, Chicago	16.25 to 16.75
No. 2 foundry, Buffalo	19.00	No. 1 cast, Chicago	19.75 to 20.25
Basic, Valley	18.50	No. 1 cast, Philadelphia	18.50 to 19.00
Basic, Buffalo	18.50 to 19.00	No. 1 cast, Birmingham	16.00 to 16.50
Malleable, Chicago	21.50	No. 1 cast, Buffalo	17.00 to 17.50
Malleable, Buffalo	19.00	Car wheels, iron, Pittsburgh	17.50 to 18.00
Coke		Car wheels, iron, Chicago	17.50 to 18.00
Connellsville foundry, coke	$4.25 to 4.75	Railroad, malleable, Chicago	17.50 to 18.00
Wise County foundry, coke	4.50 to 5.25	Agricultural, mal., Chicago	16.75 to 17.25
		Malleable, Buffalo	19.00 to 19.50

Bookings Are Low

Bookings of steel castings dropped again in August, according to the department of commerce. The total tonnage booked in steel foundries during that month represented only 51.2 per cent of capacity, compared with 54.2 per cent for July. A loss also is shown in railway steel castings, where bookings were only 42.4 per cent of capacity in August and 46.4 per cent in July. However, these totals are well ahead of last year, when during August the total bookings of steel castings was only 36.2 per cent and of railway specialties 33.8 per cent of the plant capacity reported. Similarly, in malleable lines the department reports August as showing orders booked as 49.6 per cent of the plant capacity listed, compared with 50.2 per cent in July and 51.5 per cent in June. However, these rates are each comparatively higher than the corresponding months last year. A comparison of 130 identical malleable plants shows a steady decline since January with August the low point.

Building Strong

Building construction is continuing at a high rate, the volume breaking all records. Residence and industrial types of construction are in the lead and served to bring the August total of contracts about 75 per cent ahead of the same month last year. This has had a marked effect upon the demand for certain classes of castings. Enameled sanitary ware sales have been especially satisfactory. According to the department of commerce, the total of bath tub orders received in August was 129,113, compared with about 91,000 for August, 1924. Production is keeping pace closely with orders in this particular line. Orders for lavatories totaled 144,573 compared with about 97,000 for August last year, while unfilled orders on all classes of small ware showed a satisfactory increase during the month mentioned. Cast-iron pipe sales continue satisfactory, and some foreign pipe is coming in along the eastern coast. Hand-to-mouth buying still marks the general trend in supplying foundry stocks. Slightly higher prices are noted in scrap metals, but pig-iron prices are practically unchanged. An estimate of the total pig iron production for September, according to the *Iron Trade Review* indicates a larger output. The estimated total of all classes of pig iron is 2,730,000 gross tons compared with 2,707,171 tons for August and 2,665,262 tons for July. Pig iron shipments have exceeded production, according to several producers of merchant iron in the central western section. Orders for automobile castings are remaining steady, one large jobbing interest making cylinders reporting increased specifica-

Nonferrous Operations

Plumbing goods brass foundries are busy, as are also the nonferrous foundries producing automotive requirements. Aluminum jobbing demand is fair. New York prices for nonferrous metals, according to the *Daily Metal Trade* of Oct. 2, follow: Casting copper, 13.87½c; electrolytic copper, 14.37½c to 14.50c; Straits tin, 60.37½c to 60.50c; lead, 9.50c to 9.55c; antimony, 17.25c; nickel, 38.00c; No. 12 aluminum, remelt, 24.00c. Zinc is 7.90c to 7.92½c, E. St. Louis, Ill. Average monthly prices for September follow:

New York Prices

Castings Copper	Electrolytic Copper	Lead	Tin Straits	Antimony	Aluminum 98-99	Zinc St. Louis
14.092	14.658	9.585	58.27	17.038	27.00	7.762

Personal

Thomas E. Ward, secretary of the Stowell Co., South Milwaukee, Wis., manufacturer of malleable castings, hardware, etc., has resigned and on Oct. 1 became associated with the Badger Malleable & Mfg. Co., South Milwaukee, as sales manager. Mr. Ward was connected with the Stowell company 20 years.

Robert H. Kelley, West Englewood, N. J., has resigned his position as secretary of the American Foundry Equipment Co., New York.

James M. Cherrie, formerly foundry superintendent of the Athol Machine Co., Athol, Mass., has been foundry superintendent of the new foundry of the Benjamin Isaacson Co., Cornerbrook, Newfoundland.

D. W. Maddock, director, John Maddock & Co., Ltd., Oakengates, England, is making a tour of the eastern states studying American malleable practice. Mr. Maddock's firm is a manufacturer of light and medium weight white heart malleable castings.

J. D. Wise, Osborn Mfg. Co., Cleveland, has been engaged as instructor in a course on designing for foundry practice by the John Huntington Polytechnic institute. This school maintains free evening courses and is sponsored by the Cleveland Engineering society.

K. Baenninger, president, Baenninger G. M. B. H. and Dr. Erasmus Pauly, treasurer of the same organization which is located in Giessen, Germany, are making a brief tour of the United States, studying malleable foundry practice. The company manufactures malleable iron fittings.

Vincent Delport, European manager with headquarters in London of the Penton Publishing Co., Cleveland, publisher of THE FOUNDRY, is spending several weeks in the United States. Mr. Delport attended the convention and exhibition of the American Foundryman's association which was held at Syracuse, N. Y.

August C. Vissl of Bronson, Mich., has acquired recently the Champion Brass Mfg. Co., Coldwater, Mich. The plant consists of a brass and aluminum foundry, machine shop and pattern shop.

A. B. Tucker, for many years manager of the foundry of the Central Foundry Co., Medina, N. Y. has organized the Tucker Foundry Co. to operate the plant recently closed by the former company. The plant and equipment have been purchased by the new company and operation will be continued. The company is composed of Medina business men who desired to keep the plant active rather than have it dismantled when the Central Foundry Co. decided to abandon it. F. W. Austin and F. C. Tillman are co-organizers with Mr. Tucker.

Chosen President

Albert Walton has been elected president of the J. W. Paxson Co., Philadelphia, manufacturer and producer of foundry machinery, equipment and supplies. H. M. Bougher, who for many years has been president has been elected chairman of the board of directors.

Mr. Walton has been connected with the iron and steel industry in the east for a number of years. He first was with the Pencoyd Iron Works now the Pencoyd plant of the American Bridge Co., Pencoyd, Pa., and later for six years was with the U. S. Steel Corp. as accounting and operating expert. He then was employed in an executive capacity by a number of firms including Fairbanks, Morse & Co., Chicago, M. Rumely Co., LaPorte, Ind., and Remington Arms Co., Eddystone, Pa. He was with the latter organization during the war and also was field aide for the naval consulting board.

His later activities have included important re-organization work with Henry Disston & Sons, Philadelphia and the Enterprise Mfg. Co., of the same city. Mr. Walton was vice president in charge of manufacturing for the latter company.

Handle Electrical Goods

Eicher & Bratt, Seattle, have been appointed repesentatives of the Electric Controller & Mfg. Co., Cleveland. The firm will handle equipment of the Electric Controller & Mfg. Co., and also that of the Pittsburgh Transformer Co., Jewell Electric Instrument Co., and the Electric Power Equipment Co.

Hold Second Convention

The second annual convention of the Foundrymen's association of Czechoslovakia was held in Pilsen, Sept. 25 to 28, Prof. Pisek presiding. The following papers were read and discussed: "Study of Sands," by R. Lemoine, professor at the Superior Foundry school, Paris, France; a paper on cupola practice, by G. Mehrtens, foundry engineer, Berlin; "Some cause of Waste in Foundries and How to Prevent Them," by Professor K. Pryska of the Technical University of Beno, Czechoslovakia; a paper on heat and energy conservation in foundries, by Dr. K. Hejcman, vice director of the Skoda works, Pilsen; a paper on multi-alloy systems by Prof. A. Gazunor of the School of Mines of Pribrane; "Ingot Molds" by Prof. A. Mitinsky of the school of mines; "Apprenticeship and the Teaching of Foundry Practice in France" by E. V. Ronceray, Paris; "Shrinkage in Cast Iron" by Prof. F. Hane of the Technical University of Prague. The convention was followed by visits to the Skoda works and to a municipal brewery.

Form Merger

The Saginaw Malleable Iron Co. has been merged with the Saginaw Products Co. It now is known as the Saginaw Products Co. malleable iron plant, Saginaw, Mich.

Moves Office

The Sor-Buck Co., has moved its offices from the fifth to the sixth floor, Peoples Gas building, Chicago. F. W. Sorgenfrei formerly conpected with the Pullman Co. and H. S. Buck, former president of the Armstrong Steel Casting Co., are the heads of this sales organization specializing in gray iron, malleable iron and steel castings.

Issue New Supplement On Standards

The American Society for Testing Materials has issued a 120-page pamphlet of standards adopted in 1925. The pamphlet contains 36 revised or newly adopted standards of the society, and forms the first supplement to the 1924 issue of its triennial book of standards.

Some of the standard specifications contained are those on hard drawn trolley wire, seamless brass and muntz metal for condenser tubes and ferrule stock, gypsum and its various forms such as plasters and wall board. The specifications of asphalts and coal-tar pitch for water and damp-proofing are also given.

These standards are recognized as authoritative in the field of engineering materials. The price of the pamphlet is $1.50 and may be obtained from the secretary, 1315 Spruce street, Philadelphia.

At the end of the fiscal year the United States bureau of mines had 830 employes, of whom 370 held technical positions.

Purchases Company

The Ford Chain Block Co., Philadelphia, has purchased the rights to patents, designs and equipment for the manufacture of a line of hoists now made by the Motorbloc Corp., Philadelphia, and are arranging to increase greatly the manufacture of the product. The product will be manufactured at the Ford plant. No change in policy will be made. This type of hoist was placed on the market in 1922, and now is in use in more than 50 different industries.

Publishes Bulletin On Pure Iron Alloy

The department of commerce, bureau of mines, has issued bulletin No. 484, dealing with the preparation and properties of pure iron alloys. J. F. T. Berliner, assistant physicist, conducted the experimental work. The publication describes the extension of the work done by Doctor Burgess and Mr. Scott on the thermoelectric measurement of the critical ranges of pure iron. The materials used for test purposes were an exceptionally pure series of iron-carbon alloys prepared by the bureau from vacuum-fused, electrolytic iron melted in an Arsen furnace. The ingots of the metal were annealed and rolled when hot into plates from which drillings were obtained for chemical analysis and the wire samples prepared for test purposes.

A double-wound platinum foil resistance furnace of the Hereaus type, 30 centimeters in length and controlled by a water rheostat, was used for heating the specimens. A 220 volt, 60-cycle current was used for heating the furnace. The results of these experiments are recorded by charts giving the transformations in iron and steel by heating and cooling, located by thermoelectric measurements and shown by characteristic curves. The changes in the thermoelectric properties of pure iron carbon alloys are given for temperatures up to 1150 degrees Centigrade.

To Build in South

The Agricola Furnace Co., Gadsden, Ala., has awarded a contract to the Ingalls Iron Works, Birmingham, Ala., for the construction of a large plant. The foundry will be 22 x 220 feet and equipped with two 66-inch cupolas. All machinery will be electrically driven. The company will manufacture warm air furnaces and have an annual capacity of 20,000 furnaces. This plant will be the first of its kind in the South. Otto Agricola is president, and Harry Wetter, vice president. Other members of the company are Jacob Teller and L. T. Wilcox.

Made Representatives

Manning, Maxwell & Moore Inc., New York, has been appointed sales representative of the Bridgeport Safety Emery Wheel Co., Inc., Bridgeport, Conn., to handle its line of grinding and polishing machinery throughout the United States. The company still will continue to market directly its sectional grinding wheel chucks and grinding wheels.

Opens New Branch Office

The Independent Pneumatic Tool Co., Chicago, has opened a branch office at 288 East Water street, Milwaukee. The Milwaukee branch will be in charge of C. H. DuSell, who has traveled in the Milwaukee territory for the Independent Pneumatic Tool Co., for a number of years.

Book Review

Physical Metallography by Prof. E. Heyn, translated from the German and somewhat augmented by Marcus A. Grossman, cloth, 440 pages, 6x9 inches, published by John Wiley & Sons, Inc., New York, and furnished by THE FOUNDRY, Cleveland, for $6.00 net.

Professor Heyn's investigations laid the foundation for many advances in metallography, and he stressed greatly the multiplicity of sciences involved in the study of metallography. The translator has devoted much effort to present accurately the conception of Heyn, and has succeeded remarkably well.

The book deals not only with the science of metallography, but the other sciences such as physical chemistry, physics and chemistry which are so closely related to it. Developments during freezing and cooling of alloys, methods for determining equilibrium diagrams, structure of metals and alloys, and the properties of strength and hardness are explained with exacting detail. The absorption of gases by molten metals, shrinkage phenomena, magnetic properties and the electrical conductivity of metals and alloys also are covered. The whole is well illustrated with diagrams and photographs to amplify the text matter. A complete bibliography on the subject which amplifies the text also is included.

They Said It Couldn't Be Done And He Did It

(*Concluded from Page* 844)

Ecorse, Mich., and in 1920 a third plant was erected at Lansing, Mich.

When the United States entered the war, frantic calls were sent out for the Liberty motors for the air craft. Dan received the drawings on Friday night, designed the necessary equipment, put a gang of men on the job and the following Sunday morning the first casting was in the drawing room of a Pullman on the limited headed for Detroit where the machines were assembled.

During the past two years he has carried on an extensive series of experiments with permanent molds and has succeeded in ironing out practically all the knotty wrinkles that for years have confronted and delayed investigators in this line of foundry endeavor. Despite his multitudinous activities he still finds time to play. At his magnificent home on Euclid Heights he maintains a nice putting green and on the links it is said that he shakes a particularly wicked driver.

Western Office Moved

The San Francisco office of the Penton Publishing Co., publisher of THE FOUNDRY, has been moved from 675 Monadnock building to 24 California street.

Obituary

Allen A. Tirrill, aged 52, of Pittsburgh, an inventor and consulting engineer of the Westinghouse Electric & Mfg. Co., East Pittsburgh, died Sept. 21. Mr. Tirrill was the inventor of a voltage regulator bearing his name. For many years he was associated with the General Electric Co., Schenectady, N. Y., and in 1910 became an engineer at the Westinghouse company. He left that company in 1916 but since that time had been one of its consulting engineers.

John F. Bell, member of Bell Bros., Twenty-seventh street and the Allegheny Valley railroad, Pittsburgh, operators of a foundry in connection with their smelting and refining plant, died Sept. 20 at his home in that city.

George W. Dean, superintendent of the foundry of the Hyde Windlass Co. at Bath, Me., and also mayor of Bath, died recently at his home.

TORCH ELIMINATES PRESSURE ON OIL BY USE OF VACUUM

Remove Pressure on Oil in New Torch

Cupola lighting with a new vacuum torch is shown in the accompanying illustration. This torch is made by Johnston Mfg. Co., Minneapolis. The advantages of this method for lighting the cupola are known to all foundrymen, and the principle of removing pressure on the oil by using a vacuum and atomizing effect to carry the oil to the nozzle is designed to eliminate danger of explosion or failure of the oil hose.

The entire torch outfit, and the air hose, also, if desired, may be moved by one man without uncoupling the hose from the tank. The large wheels aid in easy transportation.

Special features such as single pipe handle for torch, welded steel tank, brackets for nozzles and hose, and large nozzle of cast steel are said to lend lightness, simplicity and sturdiness to the outfit.

Develops Mold for Sash Weights

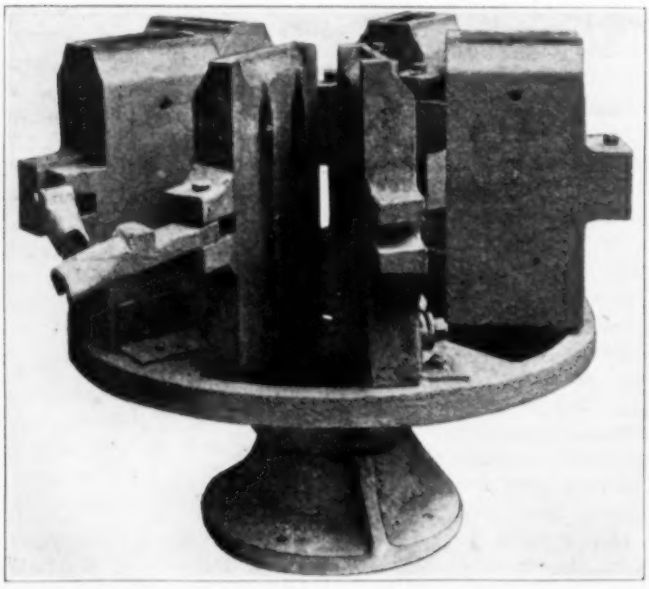
A permanent mold for casting sash weights developed by the Superior Sash Weight Co., Washington, Pa., is shown in the accompanying illustration.

The machine is made of cast iron and is furnished in two sizes one with 5 and the other with 7 molds. The mold stand revolves around a central shaft. The two halves of each mold are hinged and the locking device is of simple construction to facilitate opening and closing. Each mold contains two sash weight forms which may be from 3 to 14 pounds in weight. It is claimed that 300 sash weights per hour can be poured in this machine. The machine occupies from 5 to 7 square feet of floor space and can be placed near the cupola to take care of the over iron.

Cutting Down Coke Breeze

Since it is important that the amount of small broken coke or breeze as it is called be kept as low as possible when preparing the charge for the cupola, men with forks sometimes have been employed to handle the coke and thus keep the breeze at a minimum. A single line, clam shell bucket with shark-toothed jaws made by the Blaw-Knox Co., Pittsburgh, is being used by the Standard Foundry Co., Buffalo, to handle the coke and at the same time to decrease the amount of breeze which is formed. It is reported that not over 800 to 1000 pounds of breeze is found in unloading a car of coke by this method.

The bucket is used to unload molding sand when not in use for unloading coke. The sand comes to the foundry in a damp condition, and it is found that the bucket grabs a big load and holds it in the bucket without leaking, although the scoops are forked shaped. The Standard Foundry also uses the bucket to unload limestone from cars. A view of the bucket unloading coke is shown in the accompanying illustration.



THE MOLDS WILL TAKE CARE OF OVER IRON FROM THE CUPOLA

THE BUCKET HAS SHARK TOOTH SCOOPS TO HANDLE THE COKE

THE MACHINE IS DESIGNED FOR HIGH SPEED UNDER LOAD

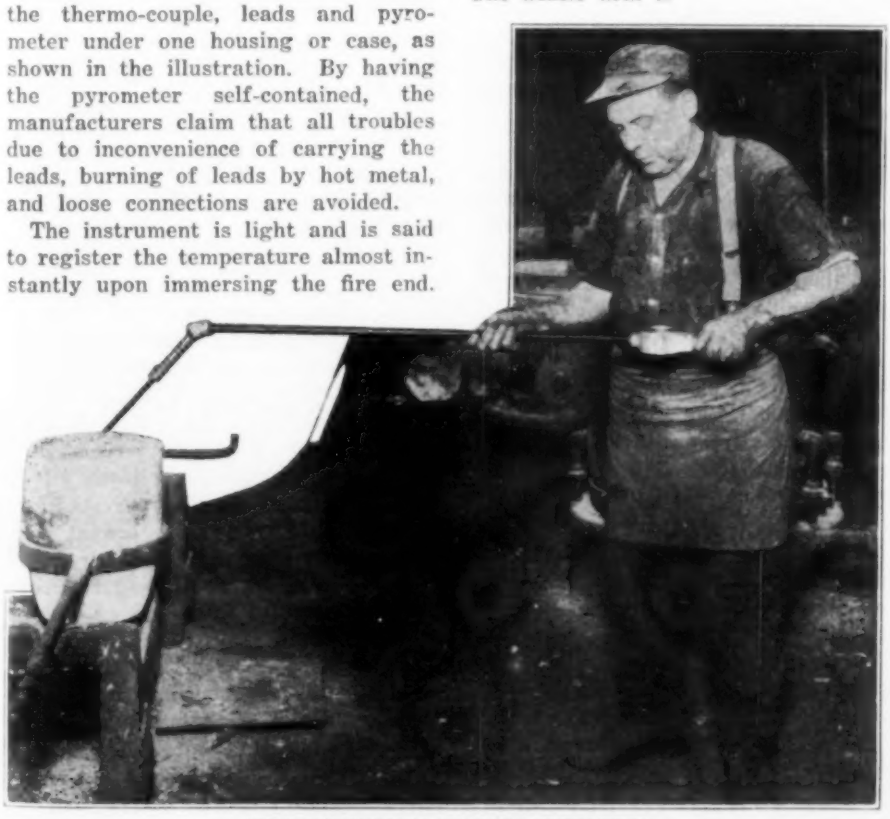
Uses Induction Motor

The Chicago Pneumatic Tool Co., New York, has introduced an electric grinder which embodies several interesting features. An induction motor is used operating on 180 cycles, the speed of a two pole motor being 10,800 revolutions per minute, and with a full load speed of approximately 8 per cent less or 9936 revolutions per minute. To operate these tools a special generator is required to furnish current at 180 cycles, 220 volts, three phase, which is the standard adopted. This frequency lends itself nicely to 60 cycle induction motor drive, being a multiple of 60 cycles, so that direct connected generator sets may be used economically. The special features claimed for this tool are greatly increased power under load, light weight and practically constant speed.

Develops New Pyrometer

Illinois Testing Laboratories Inc., Chicago, has designed a self-contained portable pyrometer for measuring temperatures of molten brass and aluminum. The instrument combines the thermo-couple, leads and pyrometer under one housing or case, as shown in the illustration. By having the pyrometer self-contained, the manufacturers claim that all troubles due to inconvenience of carrying the leads, burning of leads by hot metal, and loose connections are avoided.

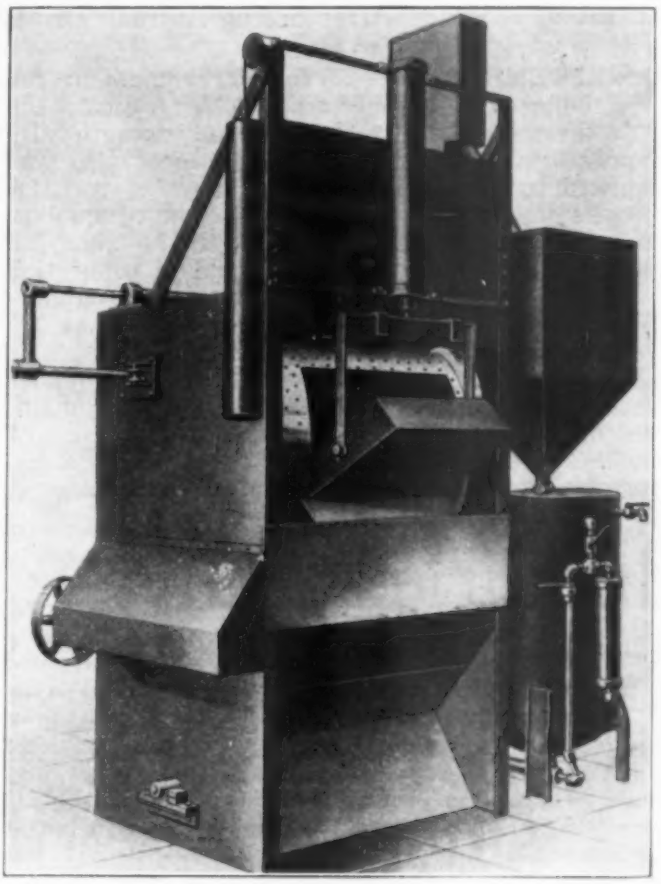
The instrument is light and is said to register the temperature almost instantly upon immersing the fire end.



NEW PYROMETER IS SELF-CONTAINED

Makes New Sand Blast

A new sandblast barrel embodying several new features in time and labor saving methods recently has been placed on the market by the Universal Shot & Sand Blast Mfg. Co., Hoboken, N. J. A view of the machine and the method of loading is shown in the accompanying illustration. Among the features claimed for the machine is the use of direct pressure nozzles which are mounted on steel sand pipe inside of the drum. The nozzles move across the full depth of the drum from end to end, similar to the direction imparted to the nozzle by the operator in a room sand blast. The nozzles are adjustable in length so that they may be placed close to any sized load. The nozzle arm is driven back and forth by a pneumatic piston mounted in the roof of the case. The abrasive is returned automatically and screened and placed in the storage bin directly over the direct pressure tank by the elevator.



A SPECIAL DEVICE IS USED TO LOAD AND UNLOAD THE BARREL

Another feature of the machine is the equipment for loading and unloading. A pneumatic piston handles the loading. Loading cans on wheels are included in the unit. The loaded cans are pushed in position in front of the machine and the hook on the piston raises the load into position. The operator then tips the truck permitting the load to enter the drum. The piston device is equipped with a catch lug for raising and lowering the case door, and has facilities for lifting and lowering the drum door.

To unload the barrel, a truck on wheels is placed directly under the drum, the door is removed and the drum rotated, permitting the load to fall into the waiting receptacle. The machine is built in two sizes, namely, 34 and 44 inches in diameter and 44 and 54 inches deep respectively.

The American Car & Foundry Co., New York, has obtained control of the Hall-Scott Motor Car Co., Oakland, Calif., manufacturer of motors for busses, trucks and marine purposes.

Show Brings Buying Increase

Foundrymen Again Give Attention to Equipment Needs After Seeing Annual Display — Exports Gain in August

SEPTEMBER sales of foundry equipment fell below the buying record for August, the latter month returning an exceptionally heavy total. The first half of October also was marked by a slight hesitancy on the part of buyers in some quarters to close on equipment. However, this may be attributed to the usual lull which precedes the exhibition held in connection with the convention of the American Foundrymen's association. While it is too early to secure reports on the business closed at the show, it is thought the sales made them and the live inquiries secured, which may be closed during the remainder of the month, will boost the total volume of business for October to an exceptionally satisfactory total and compare favorably with August sales. Exports of foundry and molding equipment increased in August, the value of exports being $59,772 as compared with $39,010 in July. A slight increase was noted over August, 1924, when the value was $57,155. The exports for the eight months ended August was $454,885 as compared with $326,496 in the corresponding period a year ago.

Unfilled orders for foundry equipment on Aug. 1, as reported by the department of commerce, showed a total value of $457,925, as compared with $460,383 on July 1. July sales totaled $353,561 as compared with $334,424 in June and $201,875 in July, 1924. Shipments in July reached a total of $352,603, as compared with June shipments of 318,442.

Inquiries Give Optomistic Trend

SEPTEMBER sales of foundry equipment in the Chicago district were better than the monthly average for the year to date, but not quite up to the level for August, which was a heavy month. The Cadillac Malleable Iron Co., Cadillac, Mich., the Bohn Aluminum & Brass Corp., Detroit, Bertsch & Co., Cambridge City, Ind. and Nichols & Shepard Co., Battle Creek, Mich., have ordered sand mixers from the National Engineering Co., Chicago. The General Electric Co., Ft. Wayne, Ind., has ordered sandblast equipment and the Advance Rumley Co., Laporte, Ind., has taken sandblast and dust arrester equipment from the Pangborn Corp., Hagerstown, Md. The Griffin Wheel Co., Council Bluffs, Ia., and the Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich., have secured shakeout and vibrator equipment from the Stoney Foundry Engineering & Equipment Co., Cleveland. The National Malleable & Steel Castings Co., Indianapolis, Ind., has purchased tumbling mill equipment, and the National Malleable & Steel Castings Co., Chicago, has taken sandblast equipment from the W. W. Sly Mfg. Co., Cleveland.

Show Helps Eastern Sellers

BUYING of foundry equipment at the exhibition held in connection with the convention of the American Foundrymen's association at Syracuse has tended to bolster up what otherwise would have been a poor showing for the first half of October for sellers of equipment in the New York district. The interest shown at the show tended to confirm the belief previously expressed in some quarters that certain buyers were waiting for the exhibition. Up to the time of the convention, trading in the eastern district had been a disappointment to many sellers. Operations still are lagging, but improvement is noted and while few new projects are appearing, approaching winter is hastening buying for some work previously mentioned and underway for some time. An active buyer is the Florence Pipe Foundry & Machine Co., Florence, N. J., which closed on one 10-ton and three 5-ton electric overhead cranes to the Morgan Engineering Co., Alliance, O., and also has purchased some miscellaneous equipment including sand handling machinery. The Otis Elevator Co., Yonkers, N. Y., has purchased sandblast equipment from the Pangborn Corp., Hagerstown, Md. The Richmond Radiator Co., Norwich, Conn., has purchased shakeout bails from the Stoney Foundry Engineering & Equipment Co., Cleveland. The Kennedy Valve Mfg. Co., Elmira, N. Y., and the Jefferson Union Co., Inc., Lockport, N. Y., have secured tumbling mill equipment from the W. W. Sly Mfg. Co., Cleveland. The American Car & Foundry Co., New York, has awarded the contract for four pitting cranes with the Shepard Electic Crane & Hoist Co., Montour Falls, N. Y. Among the prospective buyers are included the J. G. Speidel Foundry Co., Hamburg, Pa., which has started the erection of a new foundry, and the Kubler Foundries, Inc., Easton, Pa.

Cleveland Sales Slack

SALES of foundry equipment in the Cleveland territory were slack during the first part of the month, due to the interest centering in the show at Syracuse. However, a general improvement is expected during the latter half of the month. With general conditions pointing toward improvement in the operating capacity of foundries, prospects for good business in the equipment market during the remainder of the year appear bright. The John B. Morris Foundry Co., Cincinnati, has purchased tumbling mill equipment from the W. W. Sly Mfg. Co., Cleveland, while the L. G. Perkins Foundry Co., Fresno, Calif., has secured a sandblast barrel from the same manufacturer. The Hoover Suction Sweeper Co., Canton, O., has contracted for sandblast and dust arrester equipment from the Pangborn Corp., Hagerstown, Md. The Youngstown Foundry & Machine Co., Youngstown, O., has bought two furnaces for ovens now being built from the Mayor Fuel Saving Furnace Co., Cleveland, while the Reliance Steel Casting Co., Pittsburgh, has placed a repeat order for two furnaces to be attached to large mold drying ovens with the same manufacturer. The Benjamin Isaacson Co., Cornerbrook, Newfoundland, recently has purchased complete foundry equipment from Alexander Haigh, Boston,

including a sand mixer, cupola, crane and molding machines. Little new construction is appearing in this section at present.

Pittsburgh Sales Good

LATE in September sales of foundry equipment in the Pittsburgh district became more numerous as the large number of inquiries developing earlier that month reached the ordering stage. A great many inquiries are pending and sellers expect that when the figures are in for October it will prove to be the best selling month in their respective histories. This is true of foundry equipment generally, but is particularly noticeable in molding machines. Not only has there been a lot of orders booked recently, the Herman Pneumatic Machine Co. starting October with the biggest order book of its hisotry, but more inquiries are coming out than ever before. Included among recent contracts is one for four molding machines from the Richardson & Boynton Co., Dover, N. J. Each of the following companies has ordered one: The Mt. Vernon Car & Mfg. Co., Mt. Vernon, Ill.; the Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.; the C. H. Milles Foundry Co., Chicago; the Westinghouse Electric & Mfg. Co. for Cleveland; the latter order is for one of the largest machines ever built by the Herman company; it is about 22 feet long and will handle an 18-foot flask. Contracts for molding machines are expected from a number of local and nearby foundries. The Fox Furnace Co., Elyria, O., is on the list of prospective purchasers at an early date. An order for a brass melting furnace has been taken by the J. S. McCormick Co., Pittsburgh, from the Custer Sales Corp., Stoystown, Pa. A stove company at Beaver Falls, Pa., is in the market for a core oven, and the Iron City Mfg. Co., Zelienople, Pa., as soon as it orders cupolas, blowers, etc., probably will purchase core ovens and other equipment. This company has contracted for three 5-ton mill-type cranes with 42-foot 8-inch span, with the Morgan Engineering Co., Alliance, O. The Union Steel Casting Co., Pittsburgh, has contracted for sandblast and dust arrester equipment from the Pangborn Corp., Hagerstown, Md., and the Sheldon Axle & Spring Co., Wilkes Barre, Pa., has purchased sandblast equipment from the same company. The Ajax Iron Works, Corry, Pa., and the Richmond Radiator Co., Uniontown, Pa., have ordered shakeout and vibrator equipment from the Stoney Foundry Engineering & Equipment Co., Cleveland.

Several hoist inquiries are pending for nearby foundries. Flask orders are numerous, as in fact are orders for all small supplies such as riddles, crucibles, shovels, wheelbarrows, etc. The Conemaugh Iron Works Co., Blairsville, Pa., which recently suffered a disastrous fire, has not made announcement regarding the replacement of equipment but it possibly will rebuild its plant which will necessitate numerous purchases. The Bessemer Gas Engine Co., Grove City, Pa., has started three additions to its foundry, and it is thought will buy considerable machinery. The crane order for the Youngstown Foundry & Machine Co., Youngstown, O., recently referred to as going to Manning, Maxwell & Moore, Inc., for the Shaw Electric Crane Works, Muskegon, Mich., called for one each 10-ton, 15-ton and 25-ton cranes, all with 46-foot spans to be installed in their foundry.

What the Foundries Are Doing

Activities of the Gray Iron, Malleable, Steel and Brass Shops

Barnes Mfg. Co., Mansfield, O., is building an addition 60 x 80 feet to be used as a castings cleaning room, preparatory to enameling.

Lakey Foundry & Machine Co., Muskegon, Mich., is installing complete sand blasting machinery in its foundry.

Bohn Aluminum & Brass Corp., Detroit, will build an addition to its plant, general contract being let to C. H. Reisdorf.

The Simpson Foundry & Engineering Co., Newark, O., was heavily damaged by fire Sept. 24, the loss being $60,000.

St. Clair Foundry Co., Belleville, Ill., is having plans made for a 1 and 2-story furnace and stove factory at Centralia, Ill.

Hoffman Heater Co., Louisville, Ky., is considering the addition of a small brass foundry and will require complete equipment. R. C. Huddle is purchasing agent.

Heller-Murray Co., Youngstown, O., has been given the general contract for rebuilding the burned foundry of the Youngstown Foundry & Machine Co., Poland avenue.

The building occupied by Miller Motors and the Montreal Foundry Co., Montreal, Que., was destroyed by fire with loss to building and equipment of $50,000.

Southern Wheel Co., Commonwealth building, Pittsburgh, is preparing to build a car wheel plant at Goodfellow street and Terminal railroad, St. Louis.

General Steel Castings Co., Lister avenue and Chapel street, Newark, N. J., suffered loss by fire which burned its foundry. Plans for rebuilding are being made.

Plant and equipment of the Star Foundry & Machine Co., Sharon, Pa., R. D. Pearce manager, has been bought by Robert H. Dempsey, Johnsonburg, Pa.

W. S. Tyler Co., 3615 Superior avenue, Cleveland, is building an addition to its foundry and making alterations. Addition is one story and mezzanine, 38 x 40 feet.

Eagle Foundry & Machine Works, Sylacouga, Ala., is building a plant on Third street for the manufacture of fire grates and other light castings and later will produce pipe. (Noted Aug. 1).

Frank Foundries Corp., Moline, Ill., is remodeling its plant and enlarging its core department by the addition of four core ovens, molding machines and an air compressor.

Chicago Hardware Foundry Co., 549 West Washington street, Chicago, will build a 1-story addition 40 x 60 feet at North Chicago. R. Pingrey & Co., 134 South LaSalle street, Chicago, are architects.

Wilson Foundry Co., Pontiac, Mich., is installing machinery in its addition and will have it in operation several weeks before the date planned, to meet demand for automobile motors. (Noted June 1).

General Foundry Co., Anniston, Ala., recently organized, has started production of machinery parts and general foundry work in the former Bosworth-Ard machine shop. (Noted Sept. 15).

Tucker Foundry Co., Medina, N. Y., has been incorporated with $250,000 capital to operate a gray iron foundry by A. H. Tucker, F. W. Austin and F. C. Tillman. Coe & Harcourt, Medina, are attorneys.

Standard Semi-Steel Foundry Co., Springfield, Mo., C. T. Wilks general manager, is having plans made for a 1-story foundry 65x200 feet on Chase street. Traveling cranes of 5 and 10-ton capacity will be required.

General contract has been awarded the James Conforti Construction Co., 47 West Forty-second street, New York for the erection of a $55,000 extension to the plant of the John Polachek Bronze & Iron Co., at Long Island City, N. Y.

Morency Van Buren Co., Sturgis, Mich., A. F. Morency manager, is building a 1-story addition to its brass foundry 50 x 75 feet. The general contract has been let to the Boyen Construction Co., 7 Hagerman Freeland building.

The plant of the Conemaugh Iron Works Co., Blairsville, Pa., was damaged to the extent of $250,000 by fire recently, machinery and patterns suffering most. Owners probably will rebuild, although no announcement has been made.

The Freiday Mfg. Co., Freeport, Ill., recently has completed a 70 x 70-foot foundry addition and now is building a 70 x 140

foot foundry addition and also a 40 x 160-foot shipping room, the new additions making a 100 per cent increase in the capacity of the plant. The company makes toys and specialties and conducts a jobbing shop for light grey iron castings. A machine shop will be installed next year. William Freiday is president of the company.

New Trade Publications

CONCRETE BARS—A leaflet by the Gulf States Steel Co., Birmingham, Ala., presents its type of deformed reinforcing bars, with data, specifications and list of differentials.

FIBER ROOFING—Several leaflets issued by the Philip Carey Co., Cincinnati, present the advantages of its asbestos fiber roofing material and how it should be applied for best results.

MOLDING SAND—The origin, location and distribution of Albany molding sand are given in a 20-page booklet that is being distributed by Whitehead Bros. Co., Buffalo. The method of development and control is described also.

CONVEYORS.—A brochure on conveyor applications has been issued by the Cecil R. Lambert Co., Detroit. It is designed to give information leading to reduction of handling costs.

STACKERS—"Jacklift and Stacker Practice" is the title of a bulletin by the Lewis-Shepard Co., Boston, Mass., which shows 33 installations of its equipment, giving description of each.

ELECTRIC RECORDER—A bulletin by Charles Engelhard Inc., 30 Church street, New York, illustrates its electric recorder and specifications for ordering various types, with advantages of its devices.

ASH HOIST—Herbert Morris, Inc., Buffalo, N. Y., has issued a fully illustrated catalog of its ash hoists and other lifting devices for industrial use. Construction and operation are shown in detail.

FLOOR COVERING—To minimize fatigue due to standing on factory floors, the Carey Co., Cleveland, offers reasons in a bulletin why use of its type of floor covering will accomplish much in increasing physical well-being of workers and thus their output.

STATIC CONDENSERS—A revised publication has been issued by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., on static condensers covering losses from low power factor, their correction and economic application of static condensers.

OVERHEAD TROLLEYS.—Illustrations and brief description of the salient points of construction and operation of the overhead trolley systems manufactured by Herbert Morris Inc., Buffalo, N. Y., are shown in a bulletin just issued by that company.

GAS REGULATORS.—Devices for reducing pressure of gases used from pressure containers and delivering them under control at the desired pressure, with gages to indicate the pressure are featured in a bulletin by the Alexander Milburn Co., Baltimore, Md.

AFTERCOOLERS—Complete discussion on aftercoolers used in conjunction with air compressors is presented in an eight-page bulletin by the Pennsylvania Pump & Compressor Co., Easton, Pa. Cross-sectional illustrations in addition to construction data are given special attention.

BOILER TESTS—To bring to the mind of boiler users the thoroughness of tests to determine efficiency of furnaces and boilers the Combustion Engineering Co., New York, has issued a booklet covering a report of evaporative tests on boiler equipment at the River Rouge plant of the Ford Motor Co. Equipment used in the test is illustrated, interior of the plant is pictured and four tables cover 11 separate tests. Changes to be made in the equipment by the company to meet conditions shown by the tests also are shown.

PORTABLE AIR COMPRESSORS—Various types of portable compressors mounted on trucks or skids are described in a 30-page booklet issued by the Sullivan Machinery Co., New York. These compressors may be used for any purpose where compressed air is desired.

PORTABLE ELEVATOR—Telling "how it revolves," is the purpose of a bulletin by Revolvator Co., Jersey City, N. J., in which it shows the inner and outer workings of its portable elevator with the revolving base, which is its distinguishing feature.

FIRE EXTINGUISHER.—Fyr-Fyter Co., Dayton, O., has issued a bulletin describing its one-gallon extinguisher for use in industrial plants and other buildings. This is a new size designed to be portable and hand operated, with sufficient capacity to handle any incipient fire.

VACUUM RECORDER—Uehling Instrument Co., Paterson, N. J., has issued a bulletin covering its vacuum recorders, which utilize the mercury column principle and have no springs or diaphragms. An improved type of chart to attain legibility also is shown.

PORTABLE AIR COMPRESSORS—Pennsylvania Pump & Compressor Co., Easton, Pa., are presenting an 8-page pamphlet describing their portable compressor and its component parts. Capacities of various sizes of compressors are given. A table giving the air consumption of air tools is included.

WELDING—Theory and practice of electric welding are treated in a bulletin by American Electric Fusion Corp., Chicago, which strips the subject of technical features, tells it simply and describes its apparatus for obtaining the desired results in the shop.

WELDING AND CUTTING—Smith's Inventions Inc., Minneapolis, Minn., has completed its catalog illustrating its welding and cutting equipment and supplies. Details of the acetylene generator and other devices are shown by illustrations and a wide range of equipment is covered.

SAFETY DEVICES—Goggles, masks and shields to protect eyes and faces from injury in industrial operations are illustrated and described in a bulletin by the Boyer-Campbell Co., Detroit. An effective picture showing how goggles saved a pair of eyes adorns the first page.

FIRE BRICK CEMENT—Data on the new high temperature fire brick cement developed by the Chicago Fire Brick Co., Chicago, is given in a 4-page pamphlet. The cement is used to bond furnace walls into a homogeneous mass and is said to withstand high temperatures, spalling and abrasion.

SYNCHRONOUS MOTOR STARTERS—Bulletin No. 799 of the Electric Machinery Mfg. Co., Minneapolis, describes and illustrates automatic starters for synchronous motors. This bulletin explains the underlying principles of operation and suggests the proper type of starting equipment to be used for various installations. Automatic starters are of two classes, namely, full voltage starters and reduced voltage starters. Details of both are given.

DRAFT INDICATOR.—A bulletin by the Republic Flow Meters Co., Chicago, illustrates its appliances for measuring draft and pressure. The zero setting is permanent for each instrument and all readings are on one eye-level, giving the greatest possible ease of reading.

DUMB WAITER—An electric dumb waiter is described in detail in a folder just issued by the Warner Elevator Manufacturing Co., Cincinnati. The winding engine, floor selector mechanism, controller, worm drive and the sheet metal care are illustrated and described and a drawing of the entire equipment is presented.

DRILL POINTER.—A grinding machine designed to produce a theoretically correct drill point is featured in a bulletin by the Oliver Instrument Co., Adrian, Mich. Improvements and refinements in the machine are described and a graph compares the new drill point's performance with that of other forms of point.

BALL AND ROLLER BEARINGS—Bearings of the ball and roller types produced by the Norma-Hoffmann Bearings Corp., Stamford, Conn., are given full exposition as units and by their parts in catalogs by that company, one being devoted to each type. They are fully illustrated and contain much engineering information in tabular form.

SPEED TRANSFORMERS — Mechanical means other than belts to alter the rate of speed of a shaft, using some combination of enclosed gears forms the subject of a catalog issued by William Ganschow Co., Chicago. The matter is treated fully by text and illustrations, while complete data as to power ratios are given.

WATER SOFTENER—Much information relative to the problem of providing soft water for industrial use is contained in an 8-page bulletin issued by the Graver Corp., East Chicago, Ind. The water problem is stated clearly, specifications of water softening equipment are given and the operations and applications of softeners made by the company are outlined.

PYROMETERS.—Taylor Instrument Companies, Rochester, N. Y., is issuing a leaflet describing its self-contained, high temperature portable pyrometer, designed to meet demand for a low-priced instrument for intermittent rough checking purposes above the range of mercury instruments. Its range is from zero to 2200 degrees Fahr. or to 1200 degrees Cent.

ELECTRIC CONTROLLER.—Advantages of automatic control in starting large electrically driven machines by the controllers produced by the Monitor Controller Co., Baltimore, Md., is explained in a bulletin which shows a front end and side view of the apparatus that takes charge when the starting button is pushed and attends to handling the current safely until the machinery is in motion and the period of possible danger passed.

INDUSTRIAL BUILDINGS.—An annual issue of the Austin book of buildings by the Austin Co., Cleveland, is being mailed, the eighth edition. It contains a chart of the trend of building cost for seven years, table of comparative insurance rates, a ten-page technical section covering descriptions, advantages and relative cost of various types of doors, walls, roof structures, wall facings and roof waterproofings and many other features. There are also many illustrations of Austin buildings.